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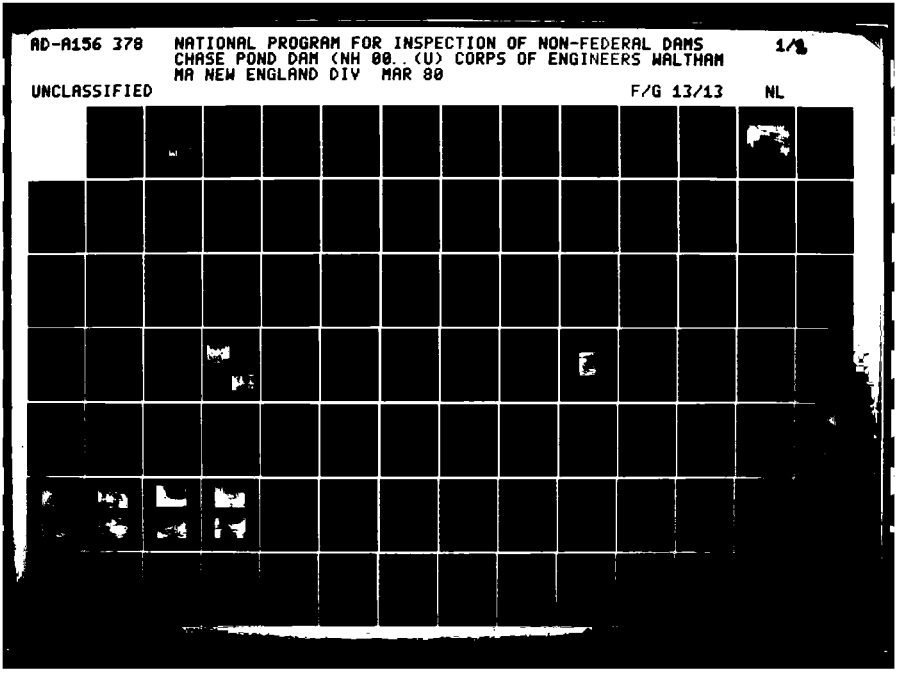

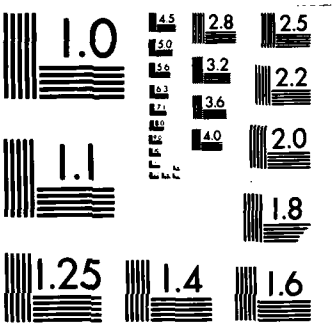

MERRIMACK RIVER BASIN

WILMOT, NEW HAMPSHIRE

CHASE POND DAM

NH 00255

NHWRB NO. 253.02

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MARCH 1980

UNCLASSIFIED

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Merrimack River Basin,
Wilmot, New Hampshire,
Chase Pond,

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a rock filled log crib with timber planking overflow strucute between stone and concrete embankments. The dam is 103 ft. lonf and about 12 ft. high. The dam is considered to be in poor condition with various major concerns. The dam is small in size with a significant hazard classification. The dam at the outlet from Tannery Pond could be overtopped or breached.

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CHASE POND DAM

NH 00255

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MERRIMACK RIVER BASIN

WILMOT, NEW HAMPSHIRE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No.:	NH 00255
Name of Dam:	Chase Pond
Town:	Wilmot Flat
County and State:	Merrimack, New Hampshire
Stream:	Chase Pond
Date of Inspection:	November 27, 1979

Chase Pond Dam is a rock filled log crib with timber planking overflow structure between stone and concrete embankments. The overall length of the dam is 103 feet. The timber overflow section is approximately 12 feet, high (neglecting flashboards) by 50.5 feet, long and 10 feet, wide at the crest. The embankments, which are approximately 5.4 feet higher than the crest of the timber overflow section, are composed of masonry and concrete on the upstream and training wall faces. The downstream faces are composed of unmortared stone and boulders. Both embankments are earth filled. There is no emergency spillway.

The dam impounds Chase Pond and the discharge flows through an unnamed brook approximately 0.2 mile to Tannery Pond. The original purpose of the dam is not known, but its present use is recreational. The pond is 0.40 mile in length with a surface area of about 39 acres. The maximum storage capacity is about 370 acre-feet.

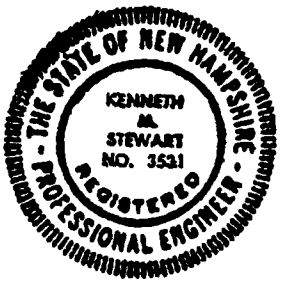
As a result of the visual inspection of this facility, the dam is considered to be in POOR condition. Major concerns are: considerable settlement of the log cribbing in the center of the spillway structure; subsidence and a sinkhole on the crest of the embankment at the left abutment; and cracking and signficiant spalling of concrete in the upstream face of the right abutment and the left training wall.

This dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The test flood for this dam, therefore, ranges from a 100-year flood to one-half the Probable Maximum Flood (1/2 PMF). The one-half Probable Maximum Flood was selected for the test flood analysis, and the test flood inflow was estimated to be 10,700 cfs. This test flood has an outflow discharge equal to 9,890 cfs and would overtop the dam crest by about 3.8 feet. The maximum spillway discharge capacity (assuming that the flashboards have washed away) with the water level at the dam crest was estimated to be 2,230 cfs or about 21 percent of the test flood discharge. A major breach with the pond surface at the dam crest would increase the stage along the immediate downstream channel by over 5 feet, possibly

damaging two of the dwellings and a barn along this reach. Water would be near the sill of these two dwellings and about 4 to 5 feet above the lower foundation of the barn. A town road and bridge which cross the stream approximately 675 feet below the dam could also be damaged. The increase in the volume of water entering Tannery Pond would significantly increase the stage of the pond approximately 6 to 8 feet, such that three or four houses located near the pond would have water 1 to 2 feet above their sills. The dam at the outlet from Tannery Pond could be overtopped or breached.

It is recommended that the owner engage a qualified registered professional engineer to investigate the settlement in the center of the log crib overflow section, the subsidence and sinkhole on the crest of the embankment at the left abutment, to do a detailed hydrologic-hydraulic investigation to assess further the potential of overtopping the dam, the adequacy of the spillway to pass the test flood, and the need for and the means to increase project discharge capacity, and to assess the need for and means to provide a low level regulating outlet that would allow drawdown of the pond in an emergency. It is also recommended that the owner repair the cracks and spalling of concrete in the upstream face of the right embankment and in the left training wall, clear the embankments and downstream toe of the dam of trees and brush and establish and maintain grassy vegetation on the embankments.

The recommendations and remedial measures are described in Section 7 and should be addressed by the owner within one year after receipt of this Phase I Inspection Report.



Kenneth M. Stewart
Project Manager
N.H.P.E. 3531

S E A Consultants Inc.
Rochester, New Hampshire

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and

rarity of such a storm event, finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespassing and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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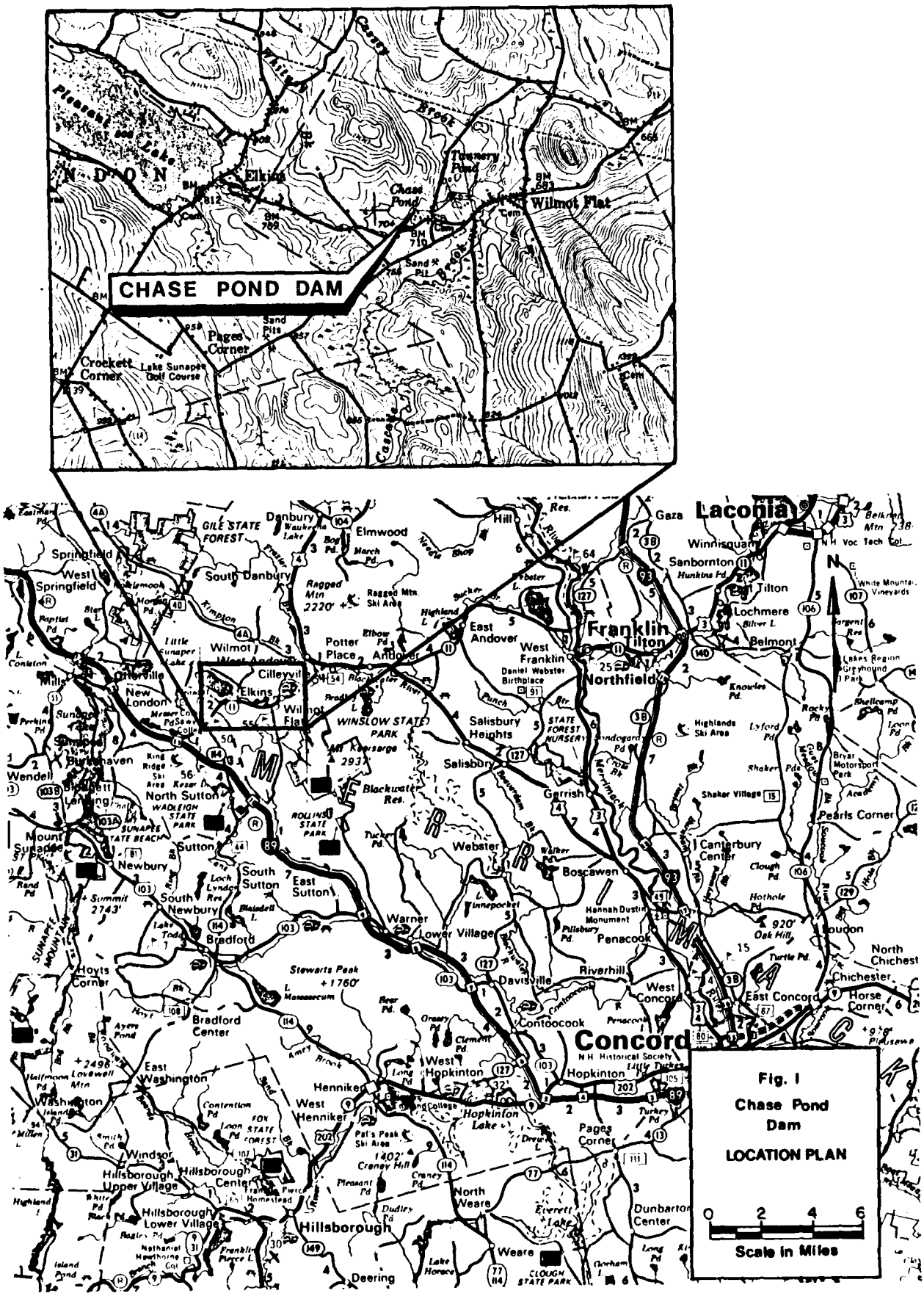

CHASE POND DAM
Fig. 1
Chase Pond
Dam
LOCATION PLAN
0 2 4 6
Scale in Miles

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CHASE POND DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. S E A Consultants Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to S E A Consultants Inc. under a letter of November 5, 1979 from William Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0008 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Chase Pond Dam is located in the Town of Wilmot, New Hampshire, approximately 0.8 mile west from the center of town. The dam impounds water creating Chase Pond, which after passing over the spillway flows in an unnamed brook in an easterly direction approximately 0.2 mile to Tannery Pond in Wilmot Flat, New Hampshire. The dam is shown on U.S.G.S. Quadrangle, Mt. Kearsarge, New Hampshire, with coordinates approximately at N 43°25'00", W 71°54'40", Merrimack County, New Hampshire (see Location Plan).

b. Description of Dam and Appurtenances. Chase Pond Dam is a rock filled log crib with timber planking overflow structure between stone and concrete embankments. The overall length of the dam is 103 feet. The timber overflow section is approximately 12 feet (neglecting flashboards) high by 50.5 feet long. The timbers are composed of 8, 10, and 12 inch diameter round logs. The logs are arranged in cribs which are rock filled except for the downstream cribs which have several void areas. The spillway deck is composed of 2" x 8" and 2" x 6" planking, and is about 10 feet wide at the top. A 2.5 foot high flashboard across the top of the spillway deck is also constructed with 2" x 6" and 2" x 8" planking.

The embankments are composed of masonry and concrete on the upstream and training wall faces. The downstream faces are composed of unmortared stone and boulders. Both embankments are earth filled.

c. Size Classification. Small (maximum hydraulic height - 17.2 feet, storage 370 acre-feet) based on storage (< 1,000 acre-feet to ≥ 50 acre-feet) as given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant hazard. A major breach with the pond surface at the dam crest would increase the stage along the immediate downstream channel by over 5 feet, possibly damaging two of the dwellings and a barn along the reach. Water would be near the sills of these two dwellings and about 4 to 5 feet above the lower foundation of the barn which is constructed directly adjacent to the stream channel. A town road and a bridge which cross the stream approximately 675 feet below the dam could also be damaged. The increase in the volume of water entering Tannery Pond would significantly increase the stage of the pond, approximately 6 to 8 feet, such that three of four houses would have water 1 to 2 feet above their sills. The dam at the outlet from Tannery Pond could be overtopped or breached. There appears to be little potential for loss of life.

e. Ownership. No information regarding the original structure or owner was found. Early records indicate it was first rebuilt in 1922, the owner at the time being N.P. Clough & Company. Ownership passed to a John and Myrtle Newcomb in the late 50's, who sold it to its present owner in 1973, that being Mrs. David Romanoff, Village Road, Wilmot Flat, New Hampshire 03287. Telephone No. (603) 526-6490.

f. Operator. The dam is maintained and operated by Mrs. David Romanoff, Village Road, Wilmot Flat, New Hampshire 03287. Telephone No. (603) 526-6490.

g. Purpose of Dam. The original purpose of this dam is not known. During its ownership by N.P. Clough & Company, between the 1920's and 1950's, it was used for industrial conservation. The present purpose of the dam is recreational.

h. Design and Construction History. No information regarding the original design or construction of the dam was found. Early records indicate it was first rebuilt in 1922. The dam was completely washed out during the 1938 flood and was rebuilt in its present form of a stone filled log crib in 1939. The log cribbing and planking was again rebuilt in 1963. In 1973, repairs were made to the concrete on the right abutment. Since that time there is no indication of any further construction being performed.

i. Normal Operating Procedures. The Chase Pond Dam is used primarily to create Chase Pond for recreational purposes. There is no normal operational procedure for this dam.

1.3 Pertinent Data

a. Drainage Area. The drainage area above the Chase Pond Dam covers nearly 13.8 square miles (8,830 acres), consisting of steep mountainous terrain surrounding Chase Pond and Pleasant Lake, which is located upstream from Chase Pond. The majority of the watershed is heavily wooded. Development within the basin is predominantly located near either Pleasant Lake or Chase Pond, since these two water bodies serve as recreational areas.

The topography in the drainage basin ranges from about 1,950 feet (NGVD) to 704 feet (NGVD). A number of small brooks are evident in the watershed, one such brook carries the outflow from Pleasant Lake to Chase Pond.

b. Discharge at Damsite

(1) Discharge at the damsite occurs over the 50.5 feet long timber planking overflow structure constructed between the stone and concrete embankments. The reservoir is maintained at an elevation near 704 feet NGVD, by flashboards which have been installed on top of the timber planking deck. During lower and normal flow periods, the discharge emanates from a 5.6' x 0.84' weir section which has been removed from the flashboard crest near the right embankment, as well as from a triangular shaped weir section near the left embankment. The triangular shaped discharge weir appears to be the result of a misalignment in the flashboard crest, rather than a designed point of discharge.

(2) Maximum known flood at damsite - unknown.

(3) The capacity of the overflow spillway with the flashboards removed and the water surface at the dam crest (elevation 707.8 feet) was estimated to be approximately 2,230 cfs.

(4) The capacity of the overflow spillway with the flashboards removed and the water surface at the test flood elevation (711.6 feet) was estimated to be approximately 4,400 cfs.

(5) The total flow through the rectangular weir section and the triangular weir section was estimated to be approximately 19 cfs with the water surface elevation at the top of the flashboards (elevation 704.0).

(6) The capacity of the spillway structure with the flashboards still in place was estimated to be 2,680 cfs with the water surface at the test flood elevation (711.6 feet).

(7) The total spillway capacity at the test flood elevation of 711.6 feet was estimated to be 4,400 cfs with the flashboards removed.

(8) The total project discharge with the water surface at the dam crest (elevation 707.8) was estimated to be 2,350 cfs with the flashboards removed. This includes a flow of 120 cfs which by-passes the spillway structure to the north of the dam.

(9) Total project discharge at test flood elevation - 9,890 cfs at 711.6 elevation.

c. Elevation (feet, NGVD) based on elevation of 704.0 shown on U.S.G.S. quad sheet assumed to be pool elevation at top of flashboards.

(1) Streambed at toe of dam - 690.6

(2) Bottom of cutoff - unknown

(3) Maximum tailwater - unknown

(4) Normal pool - 704.0

(5) Full flood control pool - N/A

(6) Spillway crest (flashboards in place) - 704.0

(7) Design surcharge (Original Design) - unknown

(8) Top of dam - 707.8

(9) Test flood design surcharge - 711.6

d. Reservoir (Length in feet)

(1) Normal pool - 2,100

(2) Flood control pool - N/A

(3) Spillway crest pool - 2,100

(4) Top of dam - 2,600

(5) Test flood pool - 3,100

e. Storage (acre-feet)

(1) Normal pool - 190

(2) Flood control pool - N/A

(3) Spillway crest pool (top of flashboards) - 190

(4) Top of dam - 370

(5) Test flood pool - 530

f. Reservoir Surface (acres)

(1) Normal pool - 39

(2) Flood-control pool - N/A

(3) Spillway crest (top of flashboards) - 39

(4) Test flood pool - 75

(5) Top of dam - 57

g. Dam

(1) Type - concrete and unmortared stone embankments, earth filled; central overflow structure, rock filled log crib with timber planking

(2) Length - 103 feet

(3) Height - 17.2 feet (maximum)

(4) Top width - 8.3 feet

(5) Side slopes - not applicable

(6) Zoning - not applicable

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - none

(10) Other - none

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - rock filled log crib with timber planking overflow structure

(2) Length of weir - 50.5 feet

(3) Crest elevation - 704.0 (top of flashboards)
703.2 (invert of rectangular weir section)
701.2 (top of spillway deck)

(4) Gates - no gates

(5) U/S Channel - Chase Pond. The banks are tree lined and there are several summer cottages on the pond. The slopes around the pond appear to be stable. No evidence of significant sedimentation was observed.

(6) D/S Channel - Water over the spillway discharges into a brook which travels in an easterly direction for about 0.2 mile, where it discharges into Tannery Pond, in Wilmot Flat, New Hampshire. The brook is covered with boulders and overhanging trees exist on its banks. A town road and bridge cross the brook just before it discharges into Tannery Pond.

j. Regulating Outlets. There is no apparent low level regulating outlet incorporated in this dam that would allow drawdown of the pond in an emergency. An inspection report from the State of New Hampshire Water Resources Board made during the 1939 reconstruction indicates provisions were made so that three sections of planking could be removed to drawdown the pond if this became necessary. It was not possible to determine, during the field inspection, if this provision still exists.

SECTION 2
ENGINEERING DATA

2.1 Design

No design data were disclosed for Chase Pond Dam.

2.2 Construction

No construction records were disclosed.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. No engineering data were available for Chase Pond Dam. A search of the files of the New Hampshire Water Resources Board and direct contact with the owner, revealed a limited amount of recorded information.

b. Adequacy. The final assessments and recommendations of this investigation are based on the visual inspection and the hydrologic and hydraulic calculations.

c. Validity. No engineering data were disclosed to validate.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Chase Pond Dam impounds a pond of small size. The watershed above the pond consists of steep mountainous terrain. The majority of the drainage basin is heavily wooded and predominantly undeveloped, except for the perimeter of Chase Pond and Pleasant Lake where numerous summer cottages and the town of Elkins are located. The downstream area is rocky in the bed of the brook and wooded on its banks. The area is slightly developed close to where the brook discharges into Tannery Brook.

The field inspection of Chase Pond Dam was made on November 27, 1979. The inspection team consisted of personnel from S E A Consultants Inc. and Geotechnical Engineers Inc. Inspection checklists, completed during the visual inspection, are included in Appendix A. At the time of inspection, water was passing approximately 7 inches deep over the 5.6 foot wide main overflow weir. The pool elevation was at approximately 703.7 NGVD. The upstream face of the dam could only be inspected above this water level.

b. Dam. Chase Pond Dam is a rock filled log crib overflow section between stone and concrete embankments (See Photo No. 2). The overall length of the dam is 103 feet. The central timber overflow section is about 12 feet high, 50.5 feet long, and 10 feet wide at the crest (See Photo Nos. 5 and 9).

At each end of the central, log-crib overflow section, there is a vertical concrete training wall which also serves as a retaining wall for the earthen embankment section that connects the central timber section and the abutment. The upstream side of both embankment sections is retained by a vertical concrete wall (See Photo No. 3). The downstream side of both embankment sections is retained by a dry stone masonry wall (See Photo No. 11), except close to the abutment, where the downstream side of the embankment is an earth slope.

The center of the log-crib spillway section has deflected approximately 1.2 feet in comparison with the top of the cribbing at the training walls (See Photo Nos. 9 and 12).

The downstream lower sections of the wood cribbing are absent of stone fill and many voids exist (See Photo No. 10).

The upstream face of the right embankment has a large vertical crack in the concrete (See Photo No. 4). The left training wall has a large horizontal crack at about the same elevation as the spillway (See Photo No. 6). There is also significant spalling of the concrete at this embankment (See Photo No. 8).

The crest of the embankment section between the central timber section and the right abutment is practically bare of vegetation. There is a tree stump in the dry-stone-masonry wall on the downstream side of this section and there are trees growing at the downstream toe of this wall (See Plans and Details in Appendix B). This is no vegetation and considerable erosion of the downstream slope of this section between the end of the dry-stone-masonry wall and the abutment. The erosion appears to be due to trespassing. The right abutment appears to be bedrock.

The crest of the embankment section between the central timber section and the left abutment has subsided several inches next to the concrete training wall (See Photo No. 7). There is also a sinkhole in the embankment next to the dry-stone-masonry wall on the downstream side of the crest (See Plans and Details in Appendix B and Photo No. 7). The crest is practically bare of vegetation, although there are a few small trees starting to grow. Logs and timbers have been dumped at the downstream toe of this embankment section (See Plans and Details in Appendix B). There are also some trees growing close to the downstream toe.

No evidence of seepage was observed on the downstream side of either embankment section.

c. Appurtenant Structures. There are no appurtenant structures for this dam.

d. Reservoir Area. The slopes around the pond appear to be stable. No evidence of significant sedimentation was observed.

e. Downstream Channel. The downstream channel is covered with boulders. Trees overhang the channel (See Photo Nos. 13 and 14).

3.2 Evaluation

Based on the results of the visual inspection, Chase Pond Dam is considered to be in poor condition.

The large settlement in the center of the log crib spillway section and large voids of stone fill in the downstream cribbing is evidence of a significant structural and stability problem.

Subsidence and a sinkhole on the crest of the embankment between the central timber section of the dam and the left abutment are evidence of a significant stability problem.

The lack of vegetation on the crest of both embankment sections of the dam results in relatively low erosion resistance in case of overtopping of the dam.

Erosion of the downstream slope of the embankment near the right abutment, apparently related to trespassing, could result in loss of the embankment, if not corrected.

Trees growing at the toe of the embankment sections and small trees growing on the crest of the embankment section near the left abutment will eventually attain sufficient size to be a possible cause of seepage and erosion problems if a tree blows over and pulls out its roots, or if a tree dies or is cut and its roots rot. Similarly, the roots connected to the tree stump in the dry-stone-masonry wall on the downstream side of the embankment section near the right abutment will rot and become potential channels of seepage and erosion.

Logs and timbers dumped at the downstream toe of the embankment section near the left abutment make it impossible to inspect that area adequately.

SECTION 4
OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The Chase Pond Dam is used primarily to create Chase Pond. There are no written or routine operational procedures.

b. Description of any Warning Systems in Effect. No written warning system exists for the dam.

4.2 Maintenance Procedures

a. General. The owner, Mrs. David Romanoff, is responsible for the maintenance of the dam. No formal maintenance was discussed.

b. Operating Facilities. There are no operating facilities incorporated into this dam.

4.3 Evaluation

The current operation and maintenance procedures for the Chase Pond Dam are inadequate to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure, as well as establish a warning system to follow in event of flood flow conditions or imminent dam failure.

SECTION 5
EVALUATION OF HYDROLOGIC/HYDRAULIC FEATURES

5.1 General. The Chase Pond Dam consists of a rock filled log crib, approximately 12 feet high, constructed between two stone and concrete embankments. The overall length of the dam is 103 feet. The central overflow spillway extends the entire 50.5 feet length of the log crib, and is formed with timber planking laid over the log crib. Flashboards have been installed to raise the reservoir level to nearly 704 feet NGVD. The dam impounds Chase Pond which serves as a recreational site. The Chase Pond Dam is classified as small in size having a maximum storage of approximately 370 acre-feet at the dam crest. Pleasant Lake is located in the same watershed, approximately 6,600 feet upstream from Chase Pond. Pleasant Lake has a surface area about five times that of Chase Pond, and obviously intercepts the majority of the runoff from the watershed before it reaches Chase Pond.

5.2 Design Data. No hydrologic or hydraulic design data were disclosed.

5.3 Experience Data. No experience data were disclosed. Maximum flood flows or elevations are unknown, although it is known that the dam was washed out in the "1938 Flood".

5.4 Test Flood Analysis. Due to the absence of detailed design and operational information, the hydrologic evaluation was performed utilizing data gathered during field inspection, watershed size and an estimated test flood equal to one-half the Probable Maximum Flood (1/2 PMF) Although the drainage area is mountainous, the "rolling curve" from the Corps of Engineers set of guide curves was used to estimate the maximum probable flood peak flow rate, in order to account for the presence of Pleasant Lake.

Based on an estimated maximum probable flood peak flow rate of 1,550 cfs per square mile and a drainage area of 13.8 square miles, the test flood inflow was estimated to be 10,700 cfs. The test flood was routed through the dam in accordance with the Corps of Engineers procedure for Estimating Effect of Surcharge Storage on Maximum Probable Discharge. The discharge was estimated to be 9,890 cfs. This analysis indicated that the dam crest would be overtopped by approximately 3.8 feet. The maximum spillway capacity (assuming that the flashboards have washed away) with the water level at the dam crest was estimated to be 2,230 cfs, which is only about 21 percent of the test flood discharge.

5.5 Dam Failure Analysis. The impact of dam failure with the reservoir surface at the dam crest was assessed utilizing the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs published by the Corps of Engineers. The analysis covered a reach extending approximately 0.4 miles downstream to Tannery Pond. Based on this analysis, the Chase Pond Dam was classified as a significant hazard.

Since the dam has a long overflow spillway, the discharge emanating from the dam with the water surface at the dam crest (elevation 707.8 feet) and with the flashboards removed would be about 44 percent of the calculated dam failure discharge. Consequently, the impact of the tailwater resulting from the discharge over the overflow spillway was taken into consideration when examining the stage in the downstream reaches. The various stages discussed in the remainder of this section include the effect of the tailwater.

Failure of the Chase Pond Dam with the reservoir surface at the dam crest would increase the stage along the immediate downstream channel by over 5 feet, possibly damaging two of the dwellings and a barn located along this reach. Water would be near the sill level of the two dwellings and would be about 4 to 5 feet above the lower foundation of the barn which is built directly adjacent to the stream channel. A town road and bridge which cross the stream approximately 675 feet below the dam could also be damaged, since it appears that the bridge opening does not have the capacity to handle the dam failure discharge. The increase in the volume of water entering Tannery Pond would significantly increase the stage of the pond approximately 6 to 8 feet, such that three or four houses located near the pond would have water 1 to 2 feet above their sills. The dam at the outlet from Tannery Pond could be overtopped or breached. It appears that there is little potential for loss of life.

SECTION 6
EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The visual examination indicates the following structural problems:

(1) The large settlement in the center of the log crib overflow section and large voids of stone fill in the downstream cribbing is evidence of a significant structural and stability problem.

(2) Subsidence and a sinkhole on the crest of the embankment between the central timber section of the dam and the left abutment is evidence of a significant stability problem.

(3) The lack of vegetation on the crest of both embankment sections of the dam results in relatively low erosion resistance in case of overtopping of the dam.

(4) Erosion of the downstream slope of the embankment near the right abutment, apparently related to trespassing, could result in loss of the embankment if not corrected.

(5) Trees growing at the toe of the embankment sections and small trees growing on the crest of the embankment section near the left abutment will eventually attain sufficient size to be a possible cause of seepage and erosion problems if a tree blows over and pulls out its roots, or if a tree dies or is cut and its roots rot.

(6) The roots connected to the tree stump in the dry-stone-masonry wall on the downstream side of the embankment section near the right abutment will rot and become potential channels of seepage and erosion.

(7) Logs and timbers dumped at the downstream toe of the embankment section near the left abutment make it impossible to inspect that area adequately.

(8) Cracks and significant spalling of concrete in the upstream face of the right embankment and in the left training wall.

6.2 Design and Construction Data

No information regarding the original design or construction of the dam was found.

6.3 Post-Construction Changes

Early records indicate the dam was first rebuilt in 1922. It was completely washed out during the 1938 flood and was rebuilt in its present form in 1939. The wood cribbing and planking was again rebuilt in 1963. In 1973, repairs were made to the concrete on the right embankment. Since that time, there is no indication any further construction has been performed.

6.4 Seismic Stability

This dam is located in Seismic Zone 2 and, in accordance with the Phase I guidelines, does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Based on the results of the visual examination, Chase Pond Dam is considered to be in poor condition. The major concerns are:

(1) Considerable settlement of the log cribbing in the center of the spillway structure

(2) Subsidence and a sinkhole on the crest of the embankment section between the central timber section of the dam and the left abutment

(3) Lack of vegetation on the crest of the embankment sections of the dam

(4) Trees at the downstream toe of the embankment sections and trees beginning to grow on the crest of the embankment section at the left end of the dam

(5) Roots connected to a tree stump in the downstream dry-stone-masonry wall at the right end of the dam

(6) Trees growing at the downstream toe of the dam

(7) Inadequacy of the spillway to pass the test flood.

(8) Apparent lack of a low level regulating outlet that would allow drawdown of the pond in an emergency

b. Adequacy of Information. Logs and timbers dumped at the downstream toe of the embankment section at the left end of the dam make it impossible to inspect that area adquately. It should be inspected after the logs and timbers have been removed.

The information available from the present visual inspection is adequate to identify the potential problems listed in 7.2. These problems require the attention of a qualified registered professional engineer who will have to make additional engineering studies to design or specify remedial measures. No other engineering studies are needed for the purposes of this Phase I inspection.

c. Urgency. The owner should implement the recommendations in 7.2 and 7.3 within one year after receipt of this Phase I report.

7.2 Recommendations

The owner should retain a registered professional engineer qualified in the design and construction of dams to do the following:

(1) Investigate the settlement of the log crib spillway in the center of the structure and design remedial measures, if necessary.

(2) Investigate the subsidence and sinkhole on the crest of the embankment section at the left end of the dam, and design remedial measures, if necessary

(3) Do a detailed hydrologic-hydraulic investigation to assess further the potential of overtopping the dam, the adequacy of the spillway to pass the test flood, and the need for and the means to increase project discharge capacity

(4) Assess the need for and means to provide a low level regulating outlet that would allow drawdown of the pond in an emergency

The owner should implement the recommendations made by the engineer.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The owner should:

(1) Repair the cracks and spalling of concrete in the upstream face of the right embankment and in the left training wall

(2) Maintain the embankment and a zone 25 feet wide at the downstream toe area free of trees and brush

(3) Establish and maintain grassy vegetation on the embankments

(4) Clear trees and brush from a zone 25 feet wide on either side of the discharge channel for a distance of 100 feet downstream from the dam

(5) Engage a registered professional engineer qualified in the design and construction of dams to make a comprehensive technical inspection of the dam once every year

(6) Establish a surveillance program for use during and after periods of heavy rainfall, and also a warning system to follow in case of emergency conditions

7.4 Alternatives

There are no practical alternatives to the recommendations of Section 7.2 and 7.3.

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: Chase Pond Dam, NH

DATE: November 27, 1979

TIME: 1:15 P.M.

WEATHER: Cool, sunny

W.S. ELEV. 703.7 U.S. 691.2 DN.S.
(U.S.G.S. Datum)

PARTY:

1. Kenneth Stewart, S E A
2. Robert Durfee, S E A
3. Bruce Pierstorff, S E A
4. Philip Ricardi, S E A
5. Ronald Hirschfeld, GEI
6. Kenneth Stern, NHWRB
7. Richard DeBold, NHWRB
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Structural stability	K. Stewart/R. Durfee	
2.	Hydrology/hydraulics	B. Pierstorff/P. Ricardi	
3.	Soils and geology	R. Hirschfeld	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Dam Embankment NAME:

DISCIPLINE: NAME:

AREA EVALUATED	CONDITIONS	
DAM EMBANKMENT	Left End of Over-Flow Section to Left Abutment	Right End of Overflow Section to Right Abutment
Crest Elevation	707.8	
Current Pool Elevation	703.7	
Maximum Impoundment to Date	Unknown	
Surface Cracks	None observed	None observed
Pavement Condition	Not paved	Not paved
Movement or Settlement of Crest	General subsidence, up to 1 ft with sink-holes next to dry stone masonry wall at d.s. edge of crest	None observed
Lateral Movement	None observed	None observed
Vertical Alignment	See "Movement or Settlement of Crest"	None observed
Horizontal Alignment	Good	Good
Condition at Abutment and at Concrete Structures	Subsidence next to concrete wall at left end of overflow section	Good
Indications of Movement of Structural Items on Slopes	None observed	None observed
Trespassing on Slopes	Timbers and logs dumped against d.s. toe	Footpath on d.s. slope next to right end of overflow section
Vegetation on slopes	One small tree on crest. Several trees at d.s. toe	Several trees at d.s. toe
Sloughing or Erosion of Slopes or Abutments	None observed	None observed
Rock Slope Protection - Riprap Failures	No rip rap	No riprap
Unusual Movement or Cracking at or Near Toe	None observed	None observed
Unusual Embankment or Downstream Seepage	None observed	None observed
Piping or Boils	None observed	None observed
Foundation Drainage Features	None observed	None observed
Toe Drains	None observed	None observed
Instrumentation System	None observed	None observed

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Dike Embankment NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	No dike
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Vegetation on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Intake Channel NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	No intake channel or intake structure
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Control Tower NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	No control tower
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Transition and conduit NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	No transition and conduit
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Outlet Structure NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	No outlet structure, or outlet channel
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Spillway Weir NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some trees overhanging, but channel is wide
Floor of Approach Channel	Not visible beneath pond surface
b. Weir and Training Walls	Wood crib weir with concrete training walls
General Condition of Concrete	Fair, a few large cracks
Rust or Staining	None visible
Spalling	Moderate
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Moderate through 2" x 8" stop logs on top of cribbing
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Trees overhang channel
Floor of Channel	Bedrock and large boulders
Other Obstructions	None observed

INSPECTION CHECK LIST

PROJECT: Chase Pond Dam, NH DATE: November 27, 1979

PROJECT FEATURE: Service Bridge NAME: _____

DISCIPLINE: _____ NAME: _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	No service bridge
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

ENGINEERING DATA

AVAILABLE ENGINEERING DATA

No Engineering Data other than past inspection reports from the State of New Hampshire Water Resource Board were available.

PAST INSPECTION REPORTS

M E M O

Date: November 30, 1979

To: Vernon A. Knowlton,
Chief Engineer

From: Ken Stern,
Water Resources Engineer

Subject: Chase's Pond Dam, No. 253.02, Wilmot Flat

On November 27, 1979 Dick DeBold and I accompanied the inspection team from SEA Consultants. The dam is a log crib with timber planking between stone and concrete abutments. It appears to be in good condition. The crest has a 6 to 9 inch sag. The abutments are in good condition with the exception of a crack in the left concrete facing and some minor erosion of the right embankment. The dam is classified as a menace structure due to possible damage to a downstream bridge. The potential for loss of life is slight. There is a dam downstream at Tannery Pond that has very little freeboard and would probably fail if Chase Pond Dam failed.

I believe any action on this dam can wait until the Corps' report is received.

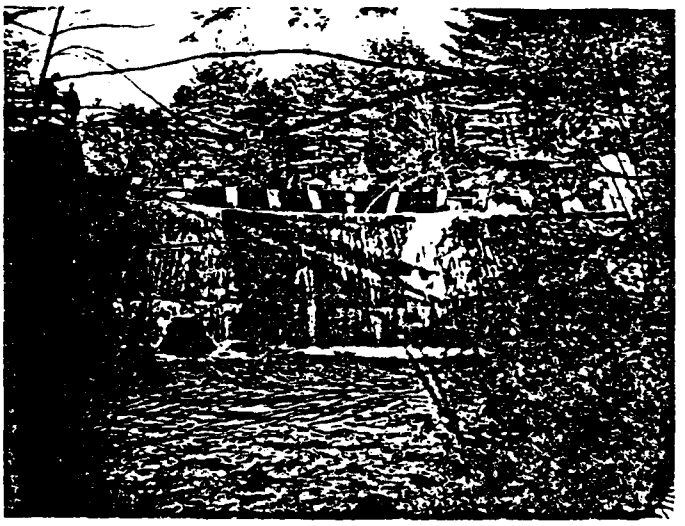
Ken

KS:paf

Dam No. 253.02, Chase's Pond Dam, inspected by Ken Stern on November 27, 1979

View from upstream

View from downstream



NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: WILMOT FLAT Dam Number: 253.02

Name of Dam, Stream and/or Water Body: CHASE'S POND DAM

Owner: ~~DAVID ROMANOFF?~~ JOHN G + MYRTLE NEWCOMBS? Telephone Number:

Mailing Address: VILLAGE RD WILMOT FLAT

Max. Height of Dam: 10' Pond Area: 36 ACRES Length of Dam: 100'

FOUNDATION: UNKNOWN - TILL W/ LARGE BOULDERS

OUTLET WORKS:
50' LONG TIMBER SPILLWAY - SLOPING U/S TIMBER SHEETING
8' FT WIDE BROAD CREST W/TIMBER PLANKING
45° SLOPING D/S TIMBER PLANKING NO BALLAST UNDER D/S PLANKING
STOP LOGS @ +18" SOME BAYS HIGHER SOME LOWER - NON FAILING
VERY LITTLE IF ANY BALLAST IN DAM
SPILLWAY SAGS 6 TO 9" @ MIDPOINT

ABUTMENTS: RT - SPLIT STONE W/ U/S CONC FACING NO SEEPAGE SOME TREES
LT - STONE W/ U/S CONC WALL - SOME SETTLEMENT + EROSION
YOUNG TREE + BUSH GROWTH
CRACK IN LT. ABUTMENT

EMBANKMENT: LT - BETWEEN STONE WALLS - GOOD MOSS COVER
SOME SMALL TREES
RT - SOME MINOR EROSION D/S END OF STONE WALL
SOME GROUND COVER SOME BARE EARTH

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No. _____

SPILLWAY: Length: 50' Freeboard: 5.5' FROM PERMANENT CREST

SEEPAGE: Location, estimated quantity, etc.

NONE OBSERVED THROUGH ABUTS

LEAKAGE THROUGH PLANKING

Changes Since Construction or Last Inspection:

Tail Water Conditions:

FREE FLOWING TO NEXT POND

1 BRIDGE D/S 40' WIDE 9' HIGH OPENING

Overall Condition of Dam: FAIR - SAGGING

Contact With Owner: NO

Date of Inspection: 11/27/79 Suggested Reinspection Date _____

Class of Dam: MENACE (LOW HAZARD)

POSSIBLE LOSS OF LIFE @ D/S ROAD CROSSING AND HOUSE BUT NOT LIKELY

Signature Kenneth Dan

Date _____

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No. _____

COMMENTS:

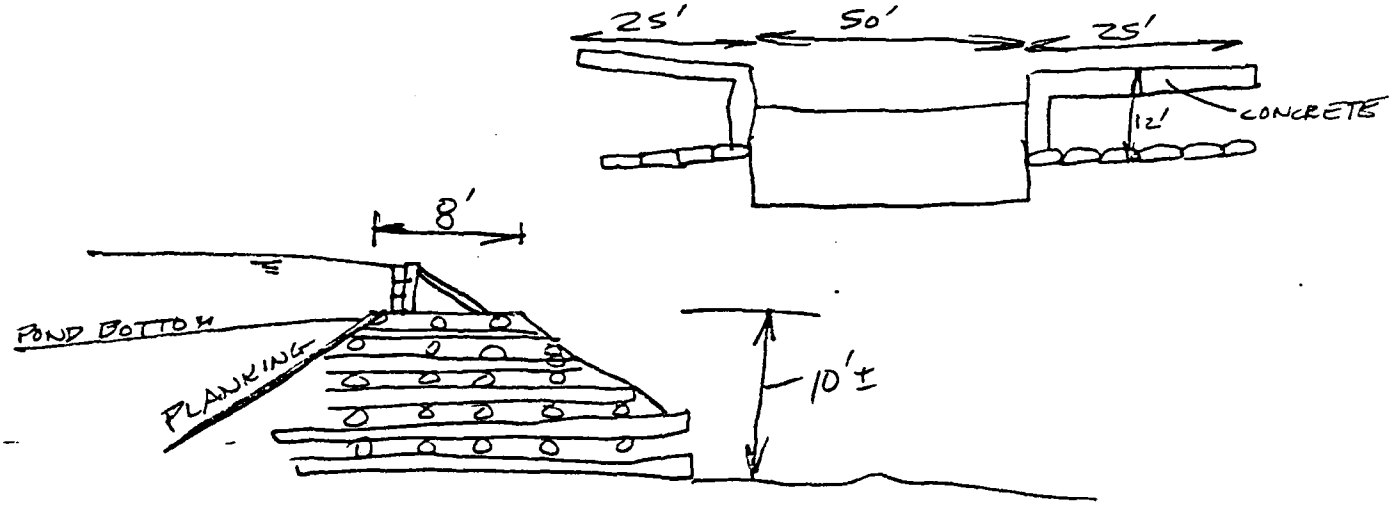
CLEAR TREE & BRUSH GROWTH

STOP LOGS NON FAILING

MONITOR SAG

Dam No._____

SKETCH OF DAM (Show Plan, Elevation & Cross Sections)



N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Wilmot Dam Number: 253.02

Inspected by: SCB Date: 22 Nov 1971

Local name of dam or water body: _____

Owner: David Romanoff Address: Village Rd Wilmot Flat

Owner was/was not interviewed during inspection.

Drainage Area: _____sq. mi. Stream: _____

Pond Area: _____Acre, Storage_____Ac-Ft. Max. Head_____Ft.

Foundation: Type_____, Seepage present at toe - Yes/No,_____

Spillway: Type_____, Freeboard over perm. crest: _____,

Width_____, Flashboard height_____,

Max. Capacity_____c.f.s.

Embankment: Type_____, Cover_____ Width_____,

Upstream slope_____ to 1; Downstream slope_____to 1

Abutments: Type_____, Condition: Good, Fair, Poor

Gates or Pond Drain: Size _____ Capacity_____ Type_____

Lifting apparatus_____Operational condition_____

Changes since construction or last inspection: _____

_____

_____

Downstream development: _____

This dam would/would not be a menace if it failed.

Suggested reinspection date: _____

Remarks: See F Moore's Report 11 Sep 69
all Concrete work in his Report has been Repaired

_____

_____

WILMOT - #253.02

NOVEMBER 22, 1974

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO

NEDPL-P

9 August 1974

Mr. David Romanoff
Village Road
Wilmot Flat, N. H. 03287

Dear Mr. Romanoff:

This is to inform you of the results of our reconnaissance investigation of the condition of Chase Pond Dam in Wilmot Flat, New Hampshire. Our study was initiated in response to a letter of 24 April 1974 from Congressman James C. Cleveland, on your behalf. The investigation was conducted under authority contained in Section 205 of the 1948 Flood Control Act, as amended.

Members of my staff met with you on 26 June 1974 to inspect the problem area. Our investigation disclosed that the dam is utilized strictly for recreation and is privately owned. In addition, the dam serves no flood control purpose. Any recreational benefits, accruable to repair or reconstruction of the dam or any appurtenant structures, could not balance the cost of such construction work. Therefore, Federal assistance is not justified in either a policy or economic sense under the authority contained in Section 205 of the 1948 Flood Control Act, as amended.

While the Corps of Engineers is unable to provide aid to you under existing authorities, the following information may be helpful to you.

Chase Pond Dam is a rock filled, timber crib overflow structure which impounds a pond having a surface area of 36 acres. The timber overflow section is about 12 feet high and 35 feet long. The timbers are composed of 8, 10, and 12-inch round logs which are in fairly good condition. These timbers are arranged in cribs which are rock filled except for the downstream cribs, which have several large void areas. The spillway deck planks, composed of 2" x 8" and 2" x 6" planks, are also in good condition except for a few nails which are exposed. The deck-planking in the middle of the structure shows signs of minor settlement.

The non-overflow abutments are composed of unmortared masonry, partially faced with concrete, and are about six feet higher than the overflow section. It was observed that the right abutment rests on bedrock while the left abutment foundation conditions could not be accurately determined within the scope of our study but, most likely, it is also founded on bedrock. The concrete facing on the left abutment showed some cracking and deterioration. A scour hole, about 3 feet deep, has been formed at the downstream toe of the overflow section. This scour hole did not appear to be undermining the cribs.

All evidence suggests that there is no serious threat to the stability of the dam and overall the dam is considered safe. However, the following remedial work should be undertaken to prevent future deterioration of the structure:

1. The nails in the deck planking which are loose should be redriven.

2. The concrete facing on the left abutment shows some cracking and deterioration of the concrete. These cracks should be sealed. This abutment will probably require a refacing, similar to that performed on the right abutment in 1973.

3. Settlement of the spillway deck planking is probably caused by minor adjustment and deterioration of the underlying timber crib and support beams. A periodic measurement of the settlement could be made to establish a time pattern of any future movements.

The item of improved flow control at Chase Pond Dam and coordination with controlled discharge from upstream lakes was evaluated. However, regulation of stream flow lies within the jurisdiction of the New Hampshire Water Resources Board and you may wish to obtain information directly from them. You should address correspondence to:

Chairman, New Hampshire Water Resources Board,
37 Pleasant St., Concord, N. H. 03301 (Tel. No. 603-271-3406)

NEDPL-P 9 August 1974
Mr. David Romanoff

Lastly, the problem of cleanup of stumps on the bottom of the lake, in addition to cleanup of the shoreline, was considered. It is suggested that before you pursue any cleanup of the pond itself, you should consult with the proper State agency that would have an interest in this problem. On this matter you should contact:

Director
New Hampshire Water Supply and Pollution Control Commission
105 Loudon Road
Concord, New Hampshire 03301
Telephone No. 603-271-3503

While the Corps of Engineers is unable to provide aid to you under existing authorities, I hope these suggestions and referrals will prove to be of assistance to you.

Sincerely yours,

JOSEPH L. IGNAZIO
Chief, Planning Division

copy furnished: ✓
Mr. Vernon Knowlton
N. H. Water Resources Board
37 Pleasant Street
Concord, N. H. 03301

DATE: September 15, 1969

FROM: Francis C. Moore

SUBJECT: Chase Pond Dam, Wilmot #253.02

TO: Vernon A. Knowlton
Water Resources Engineer

On September 11, 1969, In inspected Chase Pond dam in Wilmot. This dam is in good condition. The dam is rated as a potential menace if allowed to fall into disrepair as there are bridges and roads downstream.

The owner, John G. and Myrtle Newcomb should be notified that within a few years the upstream wing wall to the spillway (looking downstream) should be refaced with concrete as it is deteriorating considerably.

This dam should be reinspected in 1974 to determine its safety.

FCM/jb

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Wilmot Dam Number: 255.02

Inspected by: [illegible] Date: [illegible] 11 1967

Local name of dam or water body: [illegible] Pond

Owner: [illegible] Address: Wilmot [illegible] N.H.

Owner ~~was~~/was not interviewed during inspection.

Drainage Area: 12.7 sq. mi. Stream: Unnamed

Pond Area: 37 Acre, Storage 150± Ac-Ft. Max. Head 12 Ft.

Foundation: Type Ledge on abut. & prob. under spillway, Seepage present at toe - ~~Yes~~/No, No

Spillway: Type Stoplogs in bays, Freeboard over perm. crest: 5.5,

Width 50' & end restrictions, Flashboard height 2.0',

Max. Capacity [illegible] 1580 c.f.s.

Embankment: Type Concrete bulkhead, Cover earth, Width 14',

Upstream slope Vert. to 1; Downstream slope Vert. to 1

Abutments: Type Ledge, Condition: (Good) Fair, Poor

Gates or Pond Drain: Size Stop logs Capacity 4' wide 2' high Type plank (2")

Lifting apparatus None Operational condition Poor

Changes since construction or last inspection: Some deterioration of concrete in spillway, [illegible] overflow abutment on right side.

Downstream development: [illegible]

This dam would/~~would not~~ be a menace if it failed.

Suggested reinspection date: 1972

Remarks: Stop logs or flashboard would probably not [illegible] with [illegible] [illegible] in downstream side with [illegible] [illegible] dam [illegible]

[illegible] is in good condition - 30% [illegible]

THE STATE OF NEW HAMPSHIRE

County of Merrimack ss. July 12 19 63.

STATEMENT OF INTENT TO ~~CONSTRUCT OR~~

RECONSTRUCT A DAM AT CHASE POND, WILMOT, N. H.

TO THE WATER RESOURCES BOARD:

In compliance with the provisions of RSA 482:3.

~~We~~,
I, JOHN G. NEWCOMB
(Here state name of person or persons, partnership, association, corporation,

etc.)

hereby state our intent to the Water Resources Board ~~CONSTRUCT~~, to reconstruct, and/or to make repairs to, a dam ~~along or~~ (cross out portion not applicable) across:

The northeast corner of Chase Pond where a dam now exists
(Here state name of stream or body of water)

At a point See above
(Here give location, by distance from mouth of stream, county or

municipal boundary)

in the town (s) of Wilmot (Wilmot Flat) New Hampshire

in accordance with PRELIMINARY PLANS, and SPECIFICATIONS FILED WITH THIS STATEMENT AND MADE A PART HEREOF.

~~We~~, I, understand that more detailed plans and specifications may be requested by the Board in conformance with RSA 482:4 and that, if such plans are requested, construction will not commence until such plans have been filed with and approved by the Board.

The purpose of the proposed construction is to maintain Chase Pond for scenic,
(Here briefly state use to which stored water is to be put)
fishing, boating and other recreation purposes.

The construction will consist of log cribbing with two inch planks. In other words, the existing structure will be duplicated, with the exception of a gate added to the upper structure so that the water level can be lowered during the winter and spring seasons. The present height of the dam, which is about 17 feet, will not be increased.
(Here give brief description of work contemplated including height of dam)

All land to be flowed is not is owned by applicant.

John G. Newcomb

Address Village Road

Wilmot Flat, New Hampshire

Note: This statement together with plans, specifications and information and data filed in connection herewith will remain on file in the office of the Water Resources Board. This statement is to be filed in duplicate.

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 253.02

Town Wilmot : County Merrimack

Stream Chase Pd.

Basin-Primary Merrimack R. : Secondary Contoocook R.

Local Name

Coordinates—Lat. 43° 25' : Long. 71° 55'-1,650ft

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 11.5 Sq. Mi.

Overall length of dam 129 ft.: Date of Construction re-built 1922

Height: Stream bed to highest elev. 17 ft.: Max. Structure 15 ft.

Cost—Dam : Reservoir

DESCRIPTION Stone, Blocks, Concrete, earth, timber

Waste Gates

Type stone opening

Number : Size 2 ft. high x 2 ft. wide

Elevation Invert : Total Area sq. ft.

Hoist

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on: Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction plank

Length—Total 50 ft.: Net ft.

Height of permanent section—Max. 15 ft.: Min. ft.

Flashboards—Type None : Height ft.

Elevation—Permanent Crest 704 : Top of Flashboard

Flood Capacity cfs.: cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 2 ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER N.P. Clough & Co. now John G. Newcomb, V.Village Rd, Wilmot Flat, N.H.

REMARKS Condition fair Dam is Menace. Use is conservation for Ind.

Tabulation By RLT Date 9/26/39

R&B21284

MEMORANDUM

Case No.C90-C

TO: Richard S. Holmgren, Chief Engineer

RE: Case No. C90-C - Dam No. 253.02 - Chase Pond in Wilmot Flat

Made final inspection of construction of dam at Wilmot Flat on March 6, 1939. Was accompanied by representative of N.P. Clough Company and Mr. Simpson, land owner on the pond.

The dam is completed as specified with the following changes: Instead of allowing for 40 inches of freeboard, there is now an allowance of 54 inches of freeboard. There are at present installed 30 inches of flashboards and it is understood that another 10 inches will bring the pond to its natural high water level. No gate was incorporated in the structure for drawdown of the pond but provision was left for taking out three sections of planking on the upstream face if this became necessary. The flashboard bays are 8.6 feet in length using 2 x 10 stop planks. The planks are fitted with eyes for hooking out in case removal is desired of any number of stop planks. The standards holding the stop planks are feathered on to the planking with braces against the downstream face of the dam. Mr. Stanley who was present at the latter part of the inspection was of the opinion that in case of extreme head or ice pressure, these members would fail, giving us a clear spillway. There is some bending of the stop planks due to the extreme length of the bay and subject to your approval, Mr. Stanley will cut the bay length to 4.3 feet with a weaker member in the center designed to let the stop planks go out with a head at abutment height.

Subject to that change, I recommend that final approval be given to the dam, and I believe that this approval if given immediately would help Mr. Stanley as the group are holding up his pay subject to final approval of the structure by the Water Control Commission.

Respectfully submitted,

Charles D. Colman
Assistant Engineer

3/8/39

Rec'd 10/12/38

Jacobson	
Holdredge	✓
Furman	✓
Replied	
Filed	

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire

October 11, 1938.

N P Clough & Co.,
Wilmot Flat N H

RE: Chase Pond Dam. W. C. C. No 253.02

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-24 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. yes
2. If so, to what extent? Ans. Washed Caught Thru out
3. Did all flashboards go out? Ans. yes
4. What was the maximum height of water over the permanent crest of spillway? Ans. three feet
5. At what day and hour did the maximum flood height reach your dam? Ans. 8 P M Wednesday Sept. 21, 1938

6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard S. Holmgren

Richard S. Holmgren
Chief Engineer

CDC:GMB
Enc.

Dam No. 253.02
Case No. C90-C

Form WCC.1
7/30/37

THE STATE OF NEW HAMPSHIRE

County of Merrimack, ss. Dec 9 1938

PETITION FOR APPROVAL OF THE CONSTRUCTION OR REPAIR OF
DAM AT Chase Pond Webster N H

TO THE WATER CONTROL COMMISSION:

In compliance with the provisions of Laws of 1937, c.133, an Act establishing a Water Control Commission,

We, N P Clough + Co Inc
I, (Here state name of person or persons, partnership, association, corporation, etc.)

hereby petition the Water Control Commission for approval to construct, to reconstruct, ~~to make repairs to, a dam along,~~ or (cross out portion not applicable) across Blackwater river
(Here state name of stream or body of water)

at a point 1/4 mile above Village of Webster Flat
(Here give location, by distance from mouth of stream, county or municipal boundary)

in the town (s) of

in accordance with preliminary plans, and specifications filed with this application and made a part hereof.

Form WCC.1-p.2
7/30/37

The purpose of the proposed construction is for mill
(here briefly
Work. Also summer people
state use to which stored water is to be put)

The construction will consist of Timber Crib
(Here give brief description of
9 feet
work contemplated including height of dam)

All land to be flowed ~~is not~~ is owned by applicant.

Seal:

D Pclough & Co [signature]

Walnut Flat

Address

NH

Note: This application together with plans, specifications and information and data filed in connection herewith, will remain on file in the office of the Water Control Commission.

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Merrimack NO. 2 - 476 - I-3905
RIVER Chase Pond MILES FROM MOUTH D.A.SQ.MI. 11.5
TOWN Wilmot OWNER N.P. Clough Co. Wilmot Flat
LOCAL NAME OF DAM
BUILT rebuilt 1922 DESCRIPTION Gravity — Stone, Blocks, Concrete
Timber, Earth & Earth & Ledge
(Concrete + Earth AE) Photo shows plank Spillway
POND AREA-ACRES 37.10 DRAINAGE FT. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. 17 MAX. MIN.
OVERALL LENGTH OF DAM-FT. 129 MAX. FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV. U.S.G.S. 704 USGS LOCAL GAGE
TAILWATER ELEV. U.S.G.S. LOCAL GAGE 2.0
SPILLWAY LENGTHS-FT. 50 FREEBOARD-FT.
FLASHBOARDS-TYPE, HEIGHT ABOVE CREST None
WASTE GATES-NO. WIDTH MAX. OPENING DEPTH SILL BELOW CREST

REMARKS Condition Fair

4H Into Blackwater R. Contoocook R

Co-ordinates from AE
43° 25' ± 200 yds
71° 55' - 550 yds

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

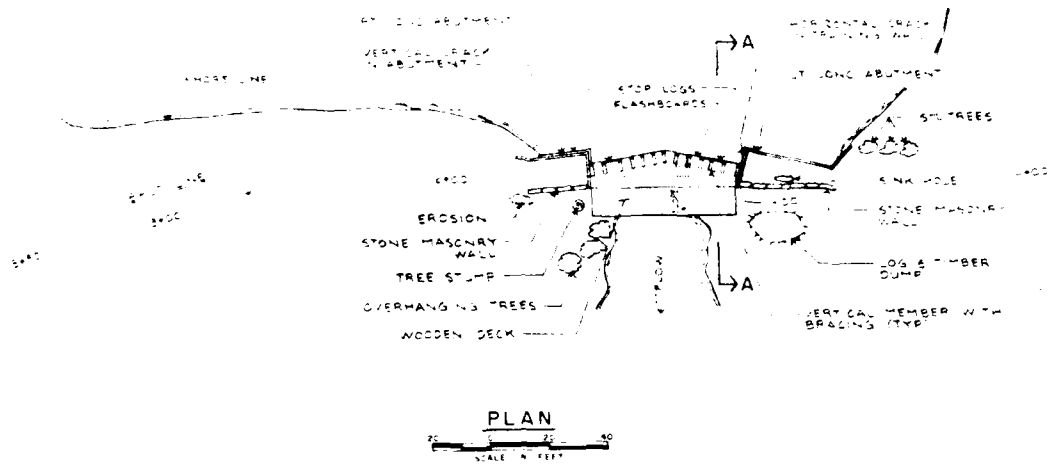
USE Conservation

REMARKS Moward
A.E got information from H. Rayno

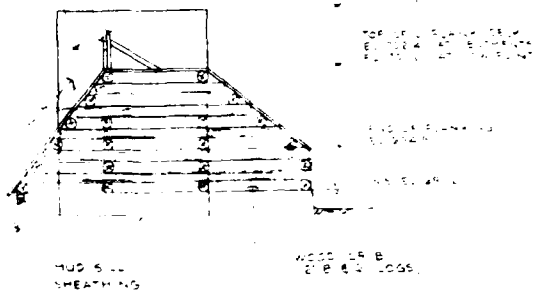
10/9/33 AE

DATE 5/31/34

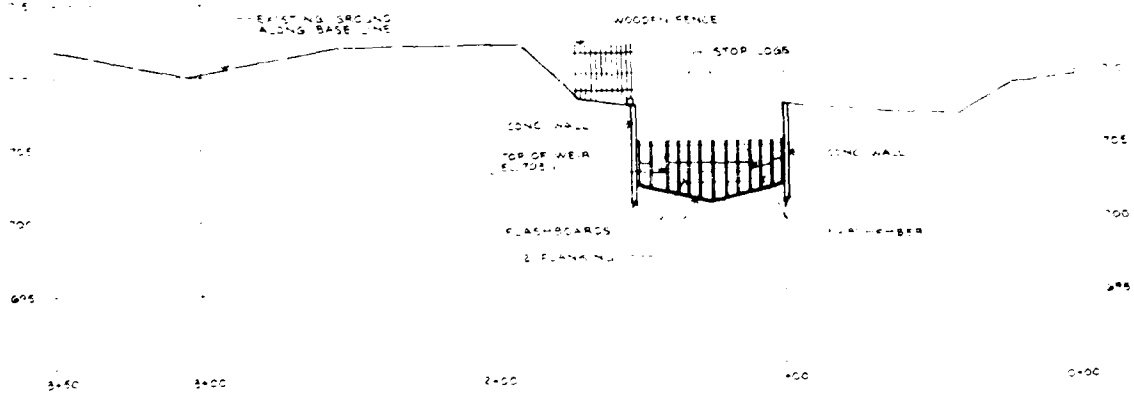
PLANS AND DETAILS



PLAN



SECTION A-A



PROFILE

CHASE POND DAM

APPENDIX C

SELECTED PHOTOGRAPHS

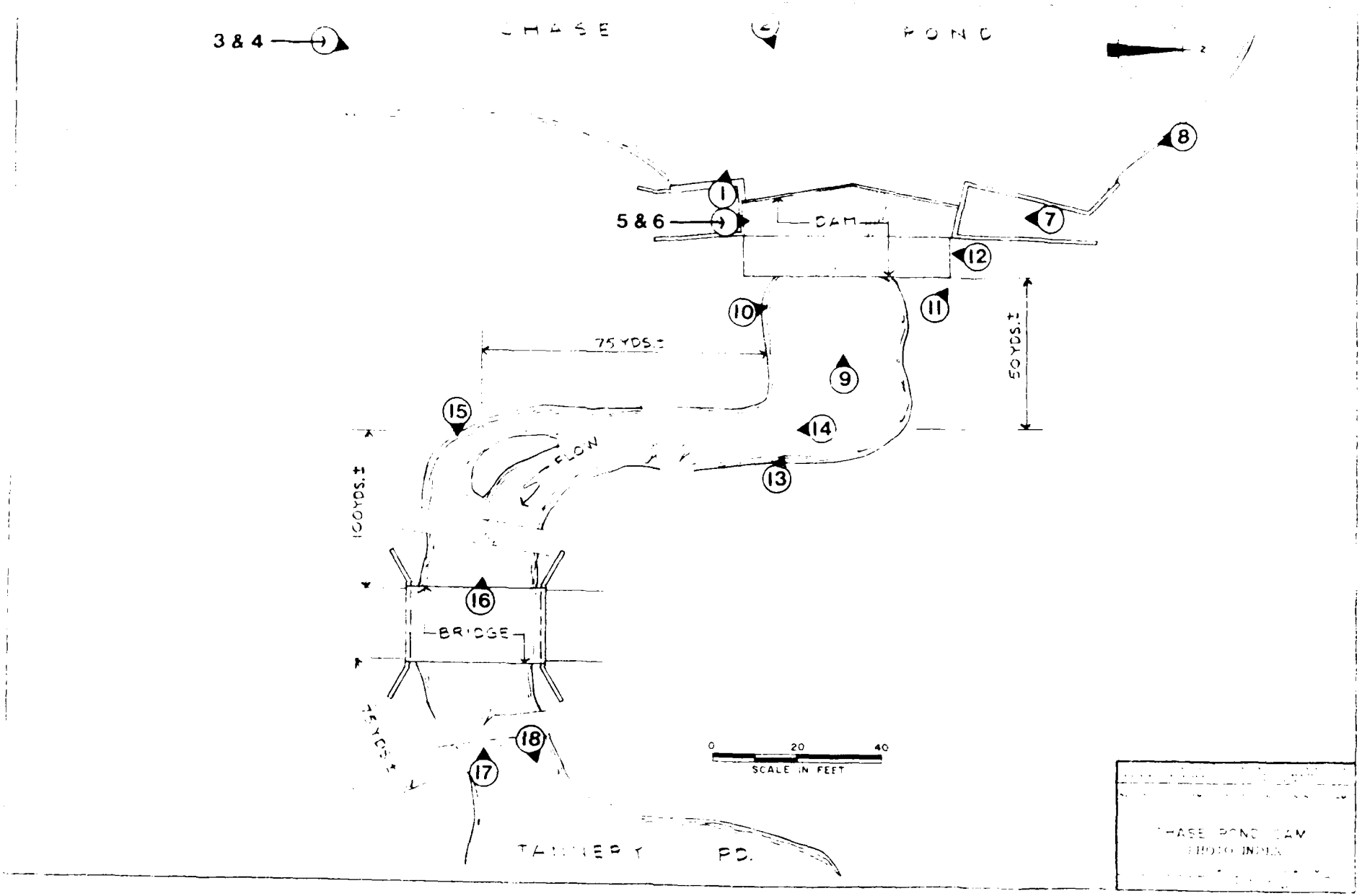

3&4
CHASE
POND
8
1
5&6
DAM
7
12
10
11
75 YDS.±
50YDS.±
9
15
14
FLOW
13
160YDS.±
16
BRIDGE
18
17
0
20
40
SCALE IN FEET
TANNERY
RD.

Photo No. 1 - General view of reservoir from right abutment.

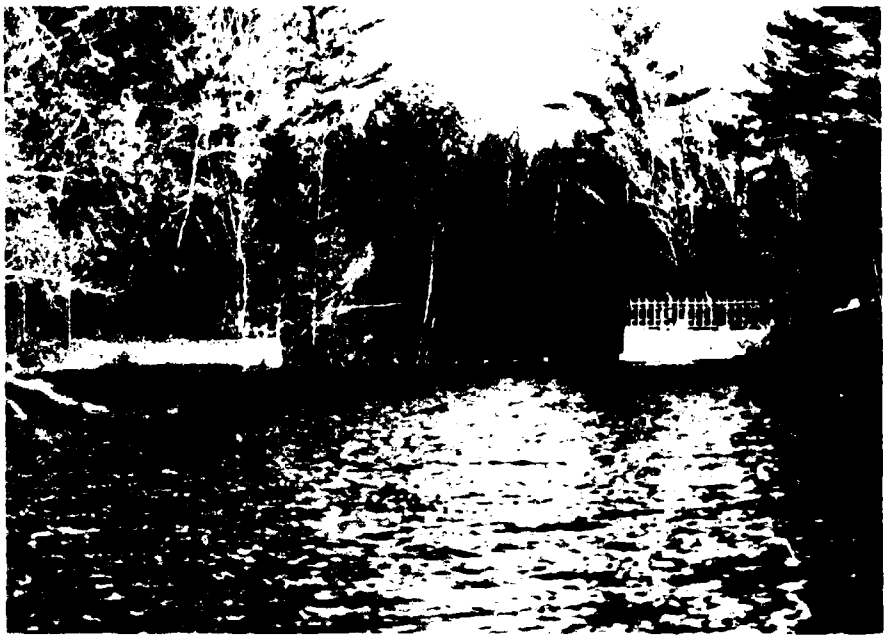


Photo No. 2 - General view of dam from reservoir.

Photo No. 5 - View of crest of dam and left abutment from right abutment.

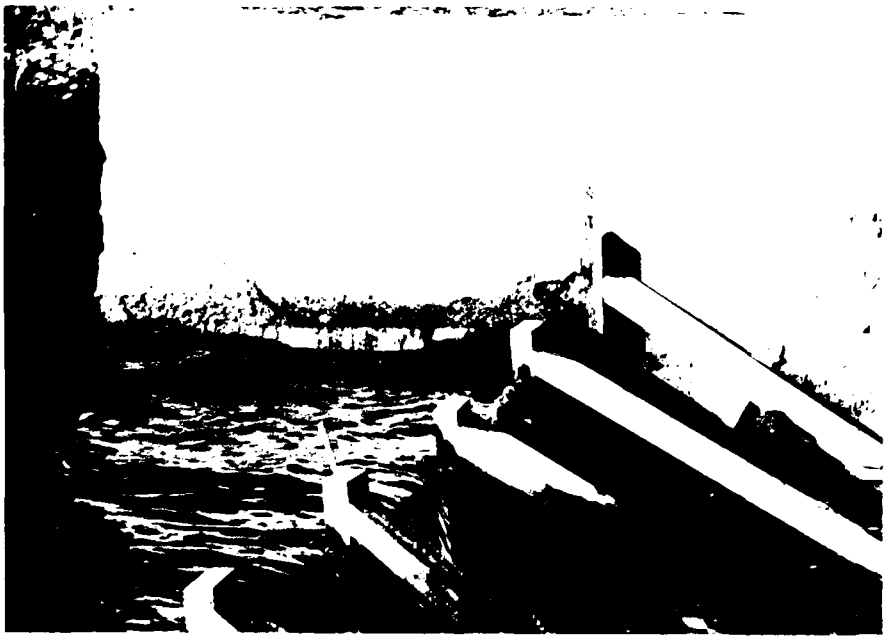


Photo No. 6 - Closeup of spalling & cracking of concrete training wall at left end of overflow section (same view as 5).

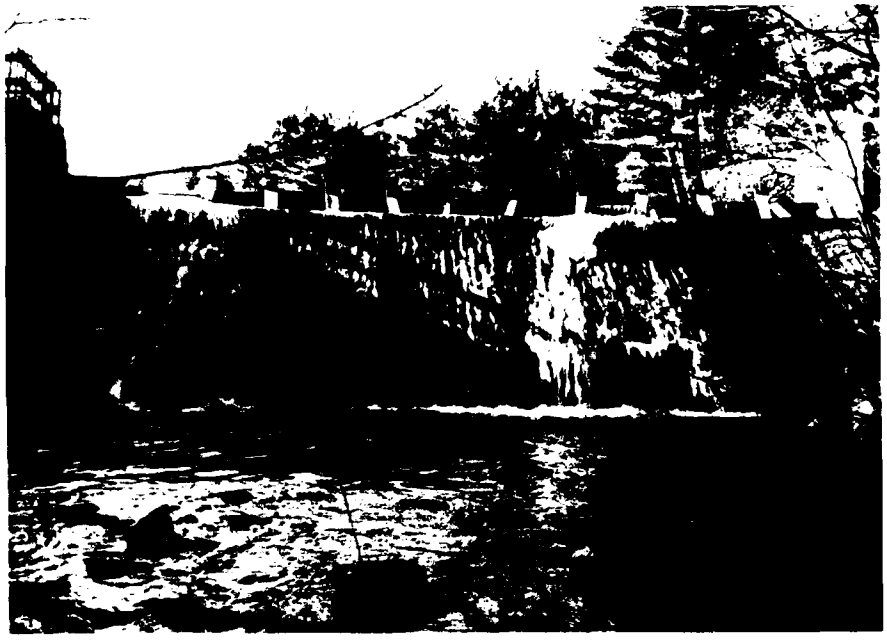


Photo No. 9 - View of overflow section looking upstream (Note depression of wood crib planking).

Photo No. 10 - Closeup of wood crib overflow section at left abutment.

Photo No. 13 - General view of dam from downstream channel.

Photo No. 14 - General view of downstream channel immediately below dam.

Photo No. 17 - View of channel and bridge looking upstream.

Photo No. 18 - General view of downstream area approximately 100 yards below bridge (Tannery Pond).

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

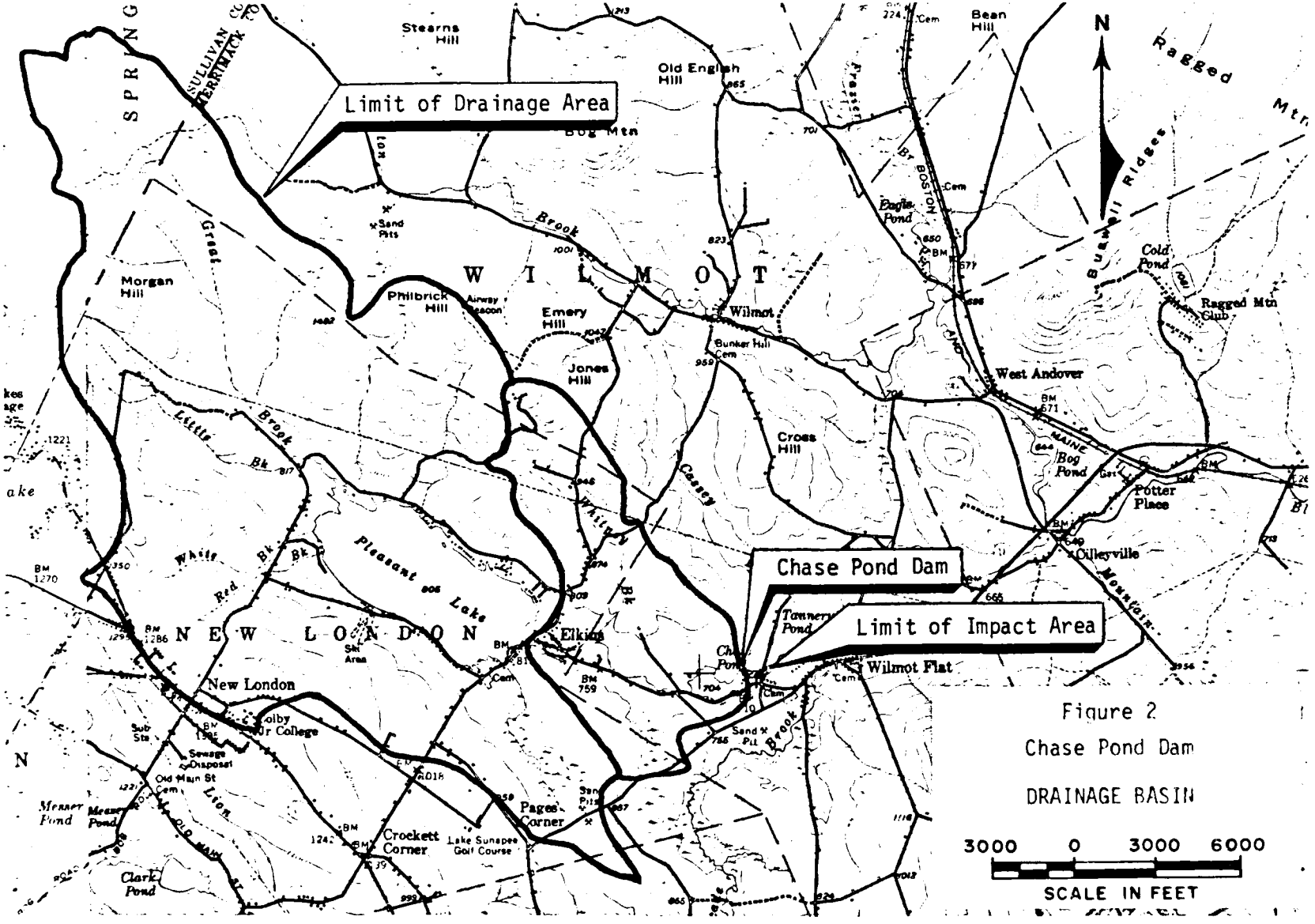


Figure 2

Chase Pond Dam

DRAINAGE BASIN

I. [illegible] Data

A. [illegible] Area

1. 13.5 square miles — as defined on U.S.G.S. sheets and [illegible] planimetered

- Drainage area would classify [illegible] since Pleasant Lake intercepts a large portion of the runoff will drop them to 7.5 [illegible] to estimate MPF Peak Flow Rates.

B. Dam and storage information

1. [illegible] Classification: SMALL [illegible] storage (<1000 Acre-ft and ≥ 50 acre-ft),

as indicated below, the storage at the crest of dam was estimated to be 370 acre-ft.

2. Hazard Potential: SIGNIFICANT
failure of dam could result in damage [illegible] to a home, a farm, a town road and other potential for loss of life exists [illegible]

- Storage Information

Descriptive Information	Elevation* (ft)	Surface Area* (acres)	Storage* (acre-feet)
Crest of dam (concrete section)	707.5	57	370
Top of flashboards (assumed 1 foot)	704.0	39	1[illegible]

S|E|A CONSULTANTS INC. BOSTON, MASS.
ENGINEERS / PLANNERS ROCHESTER, N.H.

CLIENT [illegible] JOB NO. [illegible] PAGE [illegible]
PROJECT [illegible] Dam COMPTD. BY [illegible] DATE [illegible]
DETAIL [illegible] CK'D. BY [illegible] DATE [illegible]

B. Storage Info — CONTINUED

Descriptive Information	Elevation * (ft)	Surface Area * (acres)	Storage * (acre-ft)
Pool level observed during inspection	703.7	33	173
Permanent overflow spillway	701.2	19	42
Pond Bottom	≈ 691	0	0

* Notes (1) elevations: USGS datum [illegible] taken for pool elevation shown on quadrangle sheet – elevation 704 [illegible] top of flashboards

(2) Normal pool taken [illegible]

(3) Surface area at top of dam determined from pool defined by interpolation [illegible] 707.8 contour [illegible] pond surface and the 720 contour

(4) Other intermediate surface areas [illegible] interpolations

(5) Storage at top of [illegible] pool estimated by [illegible] into [illegible] and determining [illegible] volume of [illegible]

C Spillway Information

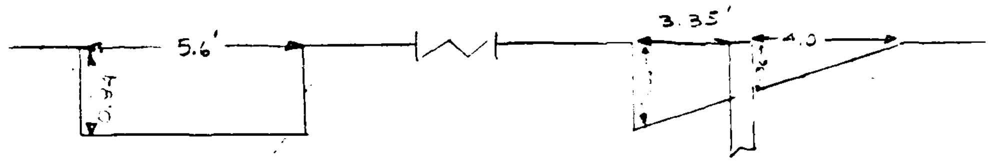
1. Permanent spillway consists of the [illegible] [illegible] portion of [illegible] which is [illegible] between the concrete abutments. Flashboards have been added to the top of the [illegible] to increase the pond elevation. [illegible] have been removed [illegible]

S|E|A CONSULTANTS INC.
ENGINEERS / PLANNERS

BOSTON, MASS.
ROCHESTER, N.H.

CLIENT [illegible]
PROJECT [illegible] Dam
DETAIL [illegible] Calcs
JOB NO. 274-79[illegible]
PAGE 3 of [illegible]
COMPTD. BY RWP
DATE 12/20/7[illegible]
CK'D. BY [illegible]MS
DATE [illegible]

[illegible] is the main overflow weir, and [illegible] second was apparently misaligned during [illegible] and serves as a secondary overflow weir.



main weir [illegible]

a. for subsequent calculations of spillway capacity it is assumed that the [illegible] will be washed away and the main [illegible] will remain intact.

2 Discharge over spillway given by (broad-crested weir)

$$Q = CLH^{3/2}$$ (Standard Handbook for CE's, Merritt)

where Q = discharge, [illegible]
C = discharge coeff. = 2.6
L = weir length, feet
H = head over weir, feet

II Estimate Surcharge Storage on Maximum Discharge

A Develop stage-discharge curve for outflow from dam

1 define sources of outflow

a flow over "permanent spillway" ([illegible]
– flashboards washed away

b. natural low point at north end of dam – [illegible] will occur above elevation 707.2
(1) treat as broad-crested weir with C = 2.6

(natural low point to south of dam — outflow will occur above elevation 707.00
(, treat as broad-crested weir

2. Spillway Outflow

Elevation (feet)	C	L (feet)	H (feet)	Q cfs
701.2	—	—	0.0	0.0
702.	2.6	31	0.8	8
703		50.5	1.8	3[illegible]
704			2.8	6.5
705			3.8	473
706			4.8	1330
707			5.8	1830
708			6.8	2330
709			7.8	2860
710			8.8	3+30
711			[illegible]	[illegible]
712			10.8	4000

3 Natural low point to north of dam plus [illegible] over crest above elev. 707.2

Elevation (feet)	C	L (feet)	H (feet)	Q cfs
707.2	—	—	0.0	0.0
708	2.6	70	0.8	175
709		100	1.8	[illegible]
710		142	2.8	730
711		195	3.8	2500
712		230	4.8	6290

4 Natural flow path to south of dam

Elevation (feet)	C	L (feet)	H (feet)	Q cfs
710	—	—	0.0	0.0
711	2.6	51	1.0	133
712	2.6	105	2.0	772

5 Total outflow - discharge vs elevation

Elevation (feet)	Q Spillway	Q North	Q South	Q TOTAL
701.2	0	0	0	0
702	81	↓	↓	81
703	317			317
704	615			615
705	973			973
706	1380			1390
707	1830	↓		1930
708	2330	175		2510
709	2860	628		3490
710	3430	1730	↓	5160
711	4030	3560	33	7620
712	4660	6290	252	11,200

Summarized graphically in Figure 1

NO. 341-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

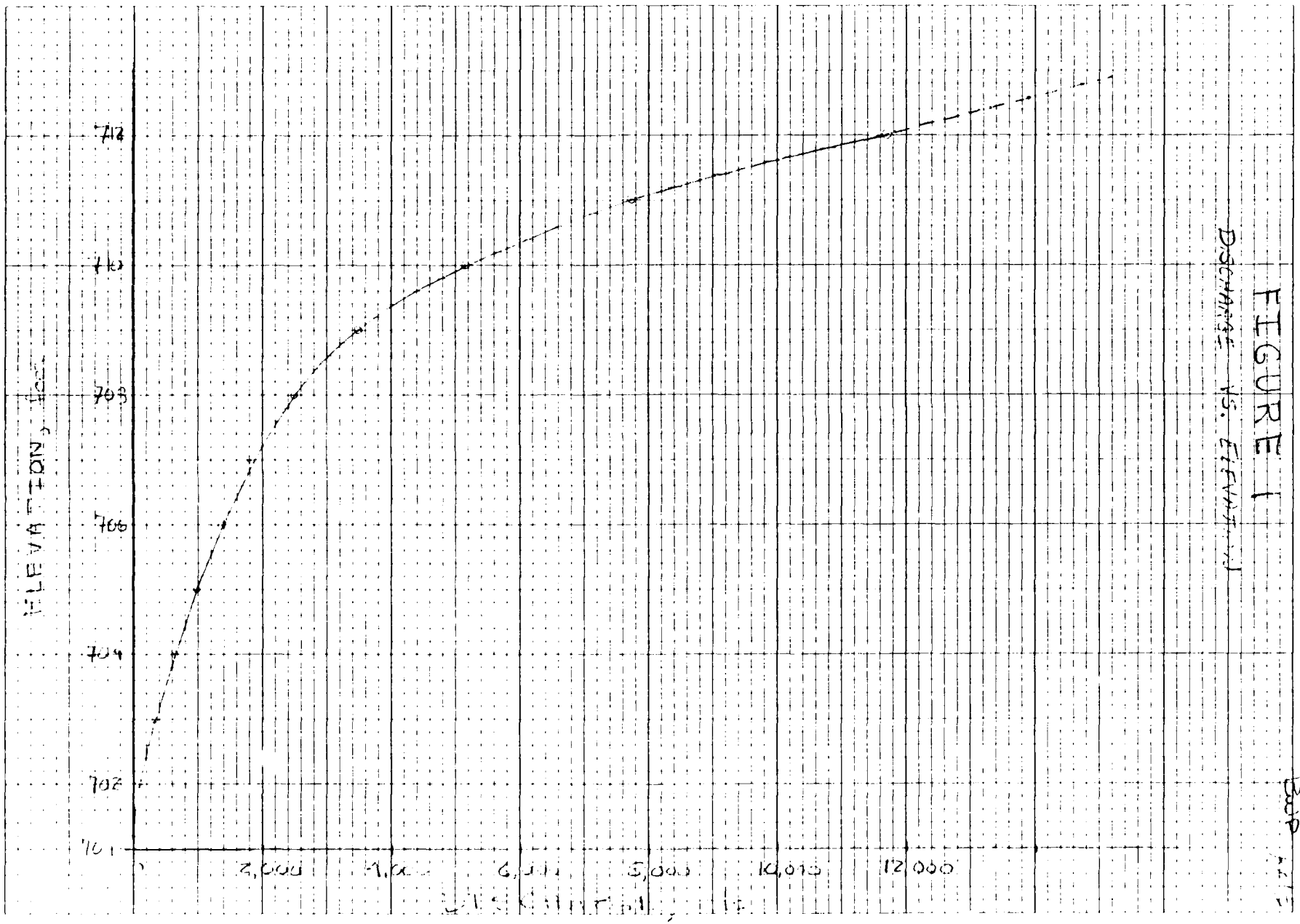


FIGURE 1

3. Effect of surcharge storage on max. outflow discharge

1. Pertinent Data
   a. Drainage area = 13.9 sq. mi
   b. Characteristics of basin — basin has mountainous terrain, however use rolling curve to account for effect of P. basement rock
   c. test flood = ½ PMF (small size and significant rainfall)
   d. follow Army Corps' procedure

2. STEP 1: Determine Peak Inflow (Q_{P1}) from Guide Curve

   a. the maximum probable discharge was estimated at 1550 cfs/sq. mi

$$\therefore \text{PMF} = (1550 \text{ cfs/sq. mi})(13.9 \text{ sq. mi})$$

$$\approx 21{,}400 \text{ cfs}$$

$$Q_{P1} = \tfrac{1}{2}\,\text{PMF} \approx 10{,}700 \text{ cfs}$$

3. STEP 2: Determine surcharge height to pass Q_{P1}, STOR, and Q_{P2}

   a. from Figure 1 determine surcharge height to pass Q_{P1} = 10,700 cfs

Surcharge elev = 71.3
- Spillway crest = 70.0
= 1.3 ft

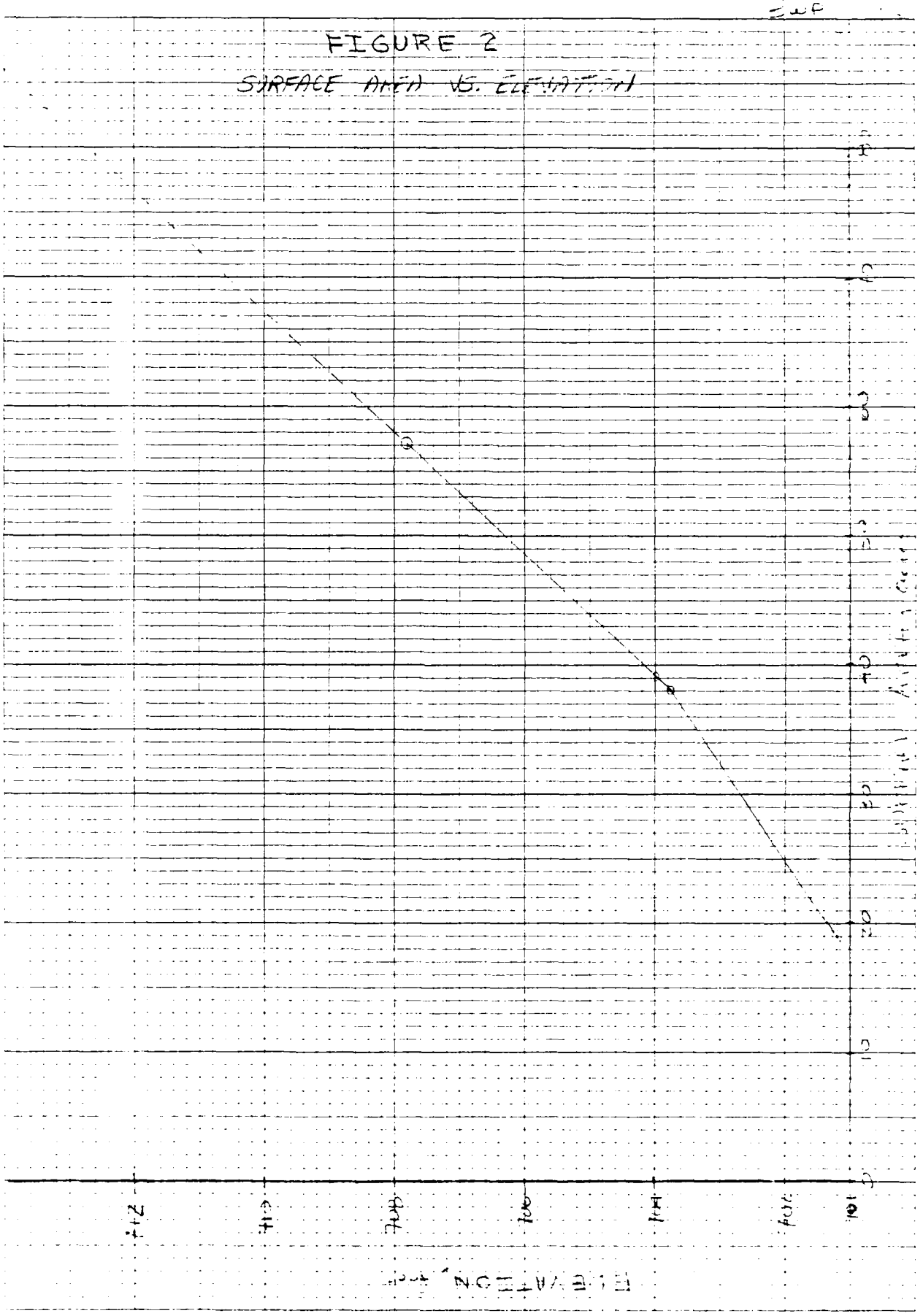
b. determine volume of surcharge storage

Job # 274-7901

Page 2 of 17
12/20/79
EWF

FIGURE 2

SURFACE AREA VS. ELEVATION



(2) Since Storage curve changes slope at approx. elev 704 top of flashboards will enter Storage above and below 704 separately

$$STOR_1 = \frac{\text{Volume of Storage (as acre-inches)}}{\text{drainage area}}$$

$$= \frac{\left[\left(\frac{75.5+39}{2}\right)(7.8) + \left(\frac{39+19}{2}\right)(2.3)\right](12 \text{ in/ft})}{(13.9 \text{ sq mi})(640 \text{ acres/sq mi})}$$

$$= 0.72 \text{ inches}$$

- determine Q_{P2}

$$Q_{P2} = Q_{P1}\left(1 - \frac{STOR_1}{9.5}\right)$$ for 9.5 and greater 1/2 PMF

$$= (10{,}700 \text{ cfs})\left(1 - \frac{0.72}{9.5}\right)$$

$$Q_{P2} = 9{,}890 \text{ cfs}$$

4 STEP 3: Determine Surcharge height and STOR2 to pass Q_{P2} and then OF3

a from Figure 1 determine Surcharge height to pass $Q_{P2} = 9{,}890$ cfs

Surcharge elev = 711.6 ft
top of f.b. = 704.0 ft = 7.6 ft

Spillway height = 7.6 / 2.8

b. Determine $STOR_3$

$$STOR_2 = \frac{\left[\left(\frac{75.0+39}{2}\right)(7.6) + 51.2\right](12 \text{ in/ft})}{(13.8 \text{ sq mi})(640 \text{ A/sq mi})}$$

$$= 0.70 \text{ inches}$$

c. Average $STOR_1$ and $STOR_2$

$$STOR_{AVG} = \frac{STOR_1 + STOR_2}{2}$$

$$= \frac{0.72 \text{ in} + 0.70 \text{ in}}{2}$$

$$= 0.71 \text{ inches}$$

$STOR_2$ and $STOR_{AVG}$ agree to within 2% ... accept test 1 ... discharge = 9,390 cfs at an elevation of 711.6 feet.

5. In Conclusion

a. Test 1 with discharge = 9,390 cfs and it will overtop the dam crest (top of abutment, ev. 3.8 ft

b. Spillway capacity - flashboards removed

(1) with water surface at dam crest - 707.8 ft

$$Q = (2.6)(50.5 \text{ ft})(707.8 \text{ ft} - 701.2 \text{ ft})^{3/2} \approx \quad \approx 2300 \text{ cfs}$$

(2) with water surface at top of abutment elevation - 711.6 ft

$$Q = (2.6)(50.5 \text{ ft})(711.6 \text{ ft} - 701.2 \text{ ft})^{3/2} \approx \quad \approx 7000 \text{ cfs}$$

III using "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs to examine impact of dam failure

Pertinent Data

a Failure occurs when reservoir level at crest of dam (top of abutment) - used elev = 707.3

b Storage at crest elevation estimated to be approximately 370 acre-ft

A REACH 1

1 STEP 1: Determine reservoir Storage at time of failure

from previous calcs storage = 230 acre-ft

2 STEP 2: Determine Peak Failure Outflow (Q_{P1})

$$Q_{P1} = 8/27\ W_b \sqrt{g}\ Y_o^{3/2}$$

where W_b = Bread width (use 40% of total length
= (0.40)(105 feet)
= 42 feet

Y_o = Total height from river bed to pool level at failure
pool level = 707.3 ft
channel bottom ≈ 690.1 ft
17.2 ft

$$Q_{P1} = (8/27)(42\text{ ft})(32.2)^{1/2}(17.2\text{ ft})^{3/2}$$

$$= 5{,}040 \text{ cfs}$$

3. STEP 3. Prepare Stage-discharge curve for Reach 1.

a. Pertinent Data
(1) Reach length – 675 feet
(2) Slope 0.022
(3) Manning "n" = 0.053
(4) Channel Shape – trapezoidal (Side slopes change at elev. 320 – above channel width = 210')
(5) Base width ≈ 20'

b. see Figure 3 for stage-discharge curve

4. STEP 4: Estimate Reach Outflow

a. Determine stage for Q_{p_1} = 5,040 cfs from Figure 3. and find volume in reach

(1) Stage = 4.8 feet

(2) Volume in reach = (reach length) (area of cross section)

$$X\text{-Area} = 0.5(4.1 \text{ ft})(20 + 210) + 0.5(0.7)(210 - 20)$$
$$= 626 \text{ ft}^2$$

$$\text{Volume} = V_1 = \frac{(675 \text{ ft})(626 \text{ ft}^2)}{43{,}560 \text{ ft}^2/\text{acre}}$$

$$= 9.7 \text{ acre-ft}$$

$V_1 < \frac{S}{2}$ reach routing OK

b. determine Q_{p_2} (routing)

$$Q_{p_2(\text{routed})} = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

$$= (5{,}040 \text{ cfs})\left(1 - \frac{9.7}{375}\right)$$

$Q_{P2(TP\ 1)} = 4910$ cfs

c. Compute V_2 using $Q_{P2(TP\ 1)}$

From Figure 2 determine stage for $Q_{P2(TP\ 1)}$

Stage = 4.8 ft

$X\text{-}Area = (0.5)(4.1)(20+21.0) + (0.5)(0.7)(210+230)$
≈ 626 ft²

$$V_2 = \frac{(675\ ft)(626\ ft^2)}{43,560\ ft^3/acre}$$

$V_2 = 9.7$ acre-ft

d Average V_1 and V_2 and compute Q_{P2}

(1) $$V_{avg} = \frac{V_1 + V_2}{2}$$

$$= \frac{9.7\ acre\text{-}ft + 9.7\ acre\text{-}ft}{2}$$

$= 9.7$ acre-ft

(2) $$Q_{P2} = Q_{P1}\left(1 - \frac{V_{avg}}{S}\right)$$

$$= (5,040\ cfs)\left(1 - \frac{9.7}{370}\right)$$

$= 4,910$ cfs

3 Reach 2

1 STEP 3: Prepare stage-discharge [illegible]

a Reach data
1 Reach length = 500'
2 Slope = 0.[illegible]5%

3. Manning's "n" = 0.08
4. Channel Shape – trapezoidal
5. base width – 100'

b. see Figure 3 for curve

2 STEP 4:

a Determine stage for Q_{P2} = 4,910 cfs from Figure 3 and volume in reach

(1) Stage = 7.1 ft

(2) Volume in reach

$$V_1 = \frac{(800\text{ ft})\left[(0.5)(7.1)(100 + 265)\right]}{43{,}560\text{ ft}^2/\text{acre}}$$

$$= 23.8\text{ acre-ft}$$

$V < \frac{S}{2}$ reach requirement

b. Determine $Q_{P3\ (TRIAL)}$

$$Q_{P3\ (TRIAL)} = Q_{P2}\left(1 - \frac{V}{S}\right),$$

$$= (4{,}910\text{ cfs})\left(1 - \frac{23.8}{370}\right)$$

$$Q_{P3\ (TRIAL)} = 4{,}590\text{ cfs}$$

c. Compute V_2 using $Q_{P3\ (TRIAL)}$

from Figure 3 determine stage for Q_{P3}

Stage = 6.9 ft

$$V_2 = \frac{(800\text{ ft})\left[0.5(6.9)(100 + 260)\right]}{43{,}560\text{ ft}^2/\text{acre}}$$

V_2 = 22.8 acre-ft

d. Average V and [illegible]

(1) V_{ave} = $\frac{23.8 \text{ acre-ft} + 22.8 \text{ acre-ft}}{2}$

= 23.3 acre-ft

(2) Q_{P3} = Q_{P2} [illegible] - $\frac{V_{ave}}{5}$

= (4,910 cfs [illegible] - $\frac{23.3}{5.0}$,

Q_{P3} = 4,600 cfs

C Reach 2

1. STEP 3: Reach 2 Prepare stage - discharge [illegible]

a Pertinent Data
1. Reach length = 650 feet
2. Slope = 0.0052
3. Manning's n = 0.05
4. Channel shape = Trapezoidal
5. Base width = 100 feet

b see Figure 3 for curve

2 STEP 4:

a Determine stage for Q_3 = 4,600 cfs from Figure 3 and routing reach

[illegible] stage = 5.1 feet

[illegible] 150 cfs

$$V_1 = \frac{(650 \text{ ft})\left[(0.5)(5.1')\left(\pi' - 5^{45}\right)\right]}{43{,}560 \text{ ft}^2/\text{acre}}$$

$$= 24.5 \text{ acre-ft}$$

$V < \frac{S}{2}$ Need iteration OK

b. Determine $Q_{P4(TRIAL)}$

$$Q_{P4(TRIAL)} = Q_{P3}\left(1 - \frac{V_1}{S}\right)$$

$$= (4600 \text{ cfs})\left(1 - \frac{24.5}{370}\right)$$

$$Q_{P4(TRIAL)} = 4{,}300 \text{ cfs}$$

c. Compute V_2 using $Q_{P4(TRIAL)}$

From Figure 3 determine Stage for $Q_{P4(TRIAL)}$

Stage = 5.0 feet

$$V_2 = \frac{(650 \text{ feet})\left[(0.5)(5.0')(100' + 540')\right]}{43{,}560 \text{ ft}^2/\text{acre}}$$

$$V_2 = 23.9 \text{ acre-ft}$$

d. Average V_1 and V_2 and compute Q_{P4}

(1) $V_{avg} = \frac{24.5 \text{ acre-ft} + 23.9 \text{ acre-ft}}{2}$

$$= 24.2 \text{ acre-ft}$$

(2) $Q_{P4} = Q_{P3}\left(1 - \frac{V_{ave}}{S}\right)$

$$= (4600 \text{ cfs})\left(1 - \frac{24.2}{370}\right)$$

$$Q_{P4} = 4{,}300 \text{ cfs}$$

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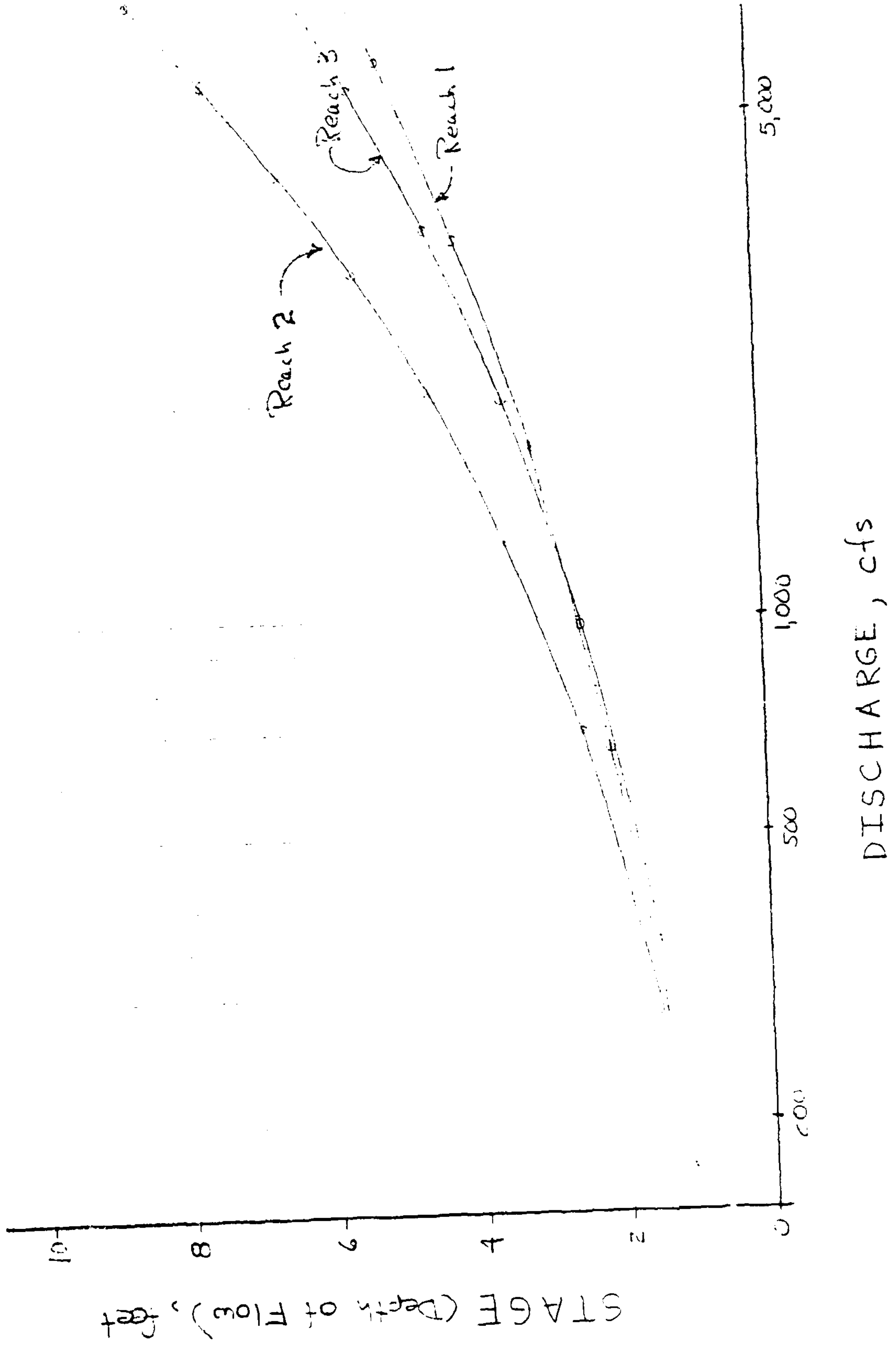
FIGURE 3
DISCHARGE vs STAGE



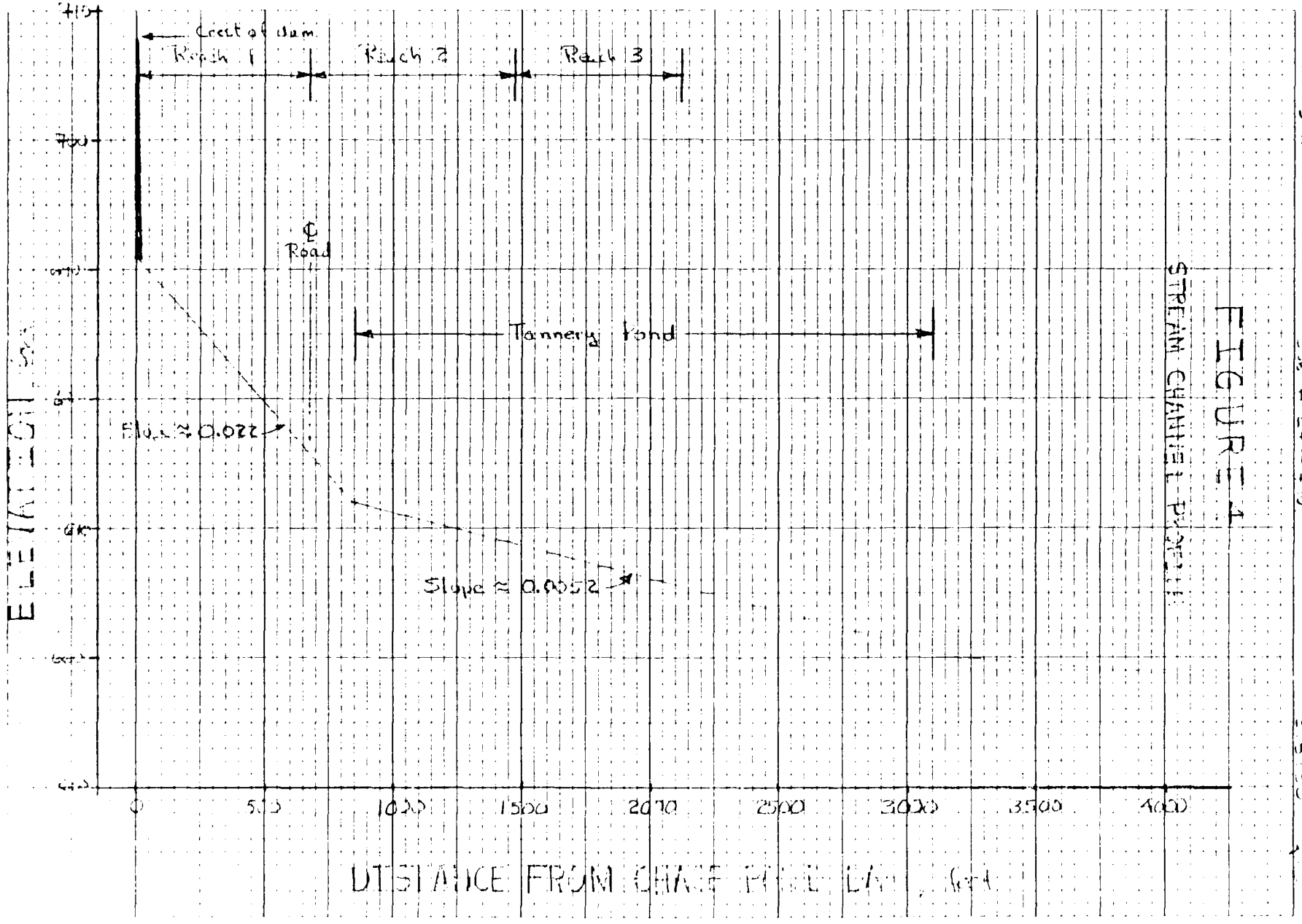


FIGURE 4
STREAM CHANNEL PROFILE

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CLIENT [illegible] Corps	JOB NO. 274-[illegible]	PAGE [illegible]	
PROJECT [illegible]	COMPTD. BY [illegible]	DATE [illegible]	
DETAIL [illegible]	CK'D. BY	DATE	

IV Examine the impact of tailwater on downstream [illegible] using the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs.

A. Reach 1

1. STEP 3 Prepare stage-discharge curve for Reach 1
   a. Pertinent data
      (1) Use stage-discharge curve prepared previously for dam failure analysis - see Figure 3
      (2) Q_{P1} = 2230 cfs - water at top of dam - [illegible] removed

a. Determine stage for Q_{P1} = 2,230 cfs from Figure 3 and find volume in reach

(1) Stage (depth of flow) = 3.5 feet

(2) Volume in reach = (reach length) (cross-sectional area of channel)

X-area = (0.5)(3.5 ft)(20 ft + 183 ft)
= 355 ft²

Volume = V_1 = (355 ft²)([illegible] ft) / 43,560 ft²/acre

= 5.5 acre-ft

$V_1 < \frac{S}{2}$ [illegible] length [illegible]

b. Determine $Q_{P2(TRIAL)}$

$Q_{P2(TRIAL)} = Q_{P1}\left(1 - \frac{[illegible]}{[illegible]}\right)$

$Q_{P2(TRIAL)}$ = (2,230 cfs)(1 - [illegible])

$Q_{P2(TRIAL)}$ = 2,200 cfs

c. Compute V_2 using Q_{p2} ([illegible])

From Figure 3 determine Q_{p2} ([illegible])

Stage = 3.4 feet

X-area = (0.5)(3.4 ft)(20[illegible] + [illegible])

≈ 338 ft²

$$V_2 = \frac{(335\ ft^2)(67[illegible]\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 5.2 acre-ft

d. Average V_1 and V_2 and [illegible] 2

(1) $V_{avg} = \frac{V_1 + V_2}{2}$

$$V_{avg} = \frac{5.5\ acre\text{-}ft + 5.2\ acre\text{-}ft}{2}$$

V_{avg} = 5.4 acre-ft

(2) $Q_{p2} = Q_{p1}\left(1 - \frac{V_{avg}}{2}\right)$

$$Q_{p2} = \left(2230\ cfs\right)\left(1 - \frac{5.4}{370}\right)$$

Q_{p2} = 2 200 cfs

B. Reach 2

1. STEP 3: Prepare stage-discharge [illegible] Prepared for dam failure analy.

a. Pertinent Data

(1) Reach length = 300 feet

(2) Channel slope = 0.0052

(3) Manning n = 0.09

(4) Channel shape - trapezoidal

(5) Base width ≈ 100 feet

b. See Figure [illegible]

2. STEP 4: Estimate Peak [illegible]

a. Determine stage for I_{P_2} = [illegible] from Figure 1 and find volume in reach.

(1) Stage (depth of flow) = 4.7 feet

(2) Volume in reach = (reach length) (cross-sectional area of channel)

X-area = (0.5)(4.7 ft)(100 ft + 20 ft)
= 729 ft²

Volume = V_1 = $\frac{(729\ ft^2)(300\ ft)}{43,560\ ft^2/acre}$

= 13.4 acre-ft

$V_1 < \frac{S}{2}$ [illegible]

b. Determine $I_{P3(TRIAL)}$

$I_{P3(TRIAL)} = I_{P2}\left(1 - \frac{1}{\quad}\right)$

$I_{P3(TRIAL)} = (2,300\ cfs)\left(1 - \frac{3.7}{\quad}\right)$

Q_{P3} = [illegible] cfs

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c. Compute V_2 using $Q_{P3(TRIAL)}$

From Figure 3 determine ... 3

Stage = 4.6 feet

X-area = (0.5)(4.6 ft)(...)

= 708 ft²

$$V_2 = \frac{(708\ ft^2)(800\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 13.0 acre-ft

d. Average V_1 and V_2 and compute Q_{P3}

(1) $Vavg = \frac{V_1 + V_2}{2}$

$$V_{avg} = \frac{13.4\ acre\text{-}ft + 13.0\ acre\text{-}ft}{2}$$

Vavg = 13.2 acre-ft

(2) $Q_{P3} = Q_{P2}\left(1 - \frac{Vavg}{S}\right)$

$Q_{P3} = (2{,}200\ cfs)\left(1 - \frac{13.2}{...}\right)$

Q_{P3} = 2,120 cfs

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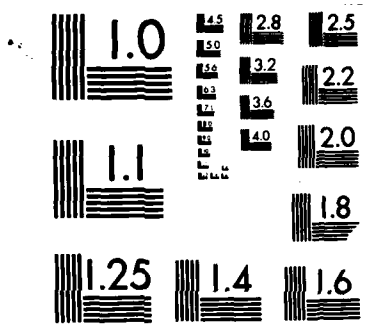


C. Reach 3

1. STEP 3: Prepare stage-discharge curve for Reach 3 - Previously Prepared for dam failure analysis

a. Pertinent Data

(1) Reach length = 650 feet

(2) Channel slope = 0.0052

(3) Manning n = 0.09

(4) Channel shape - trapezoidal

(5) Base width ≈ 100 feet

b. See Figure 3 for stage-discharge curve

2 STEP 4: Estimate Reach Outflow

a. Determine stage for Q_{P3} = 2,120 cfs from Figure 3 and find volume in reach

(1) Stage (depth of flow) = 3.6 feet

(2) Volume in reach = (reach length) (cross-sectional area of channel)

X-area = (0.5)(3.6 ft)(100 ft + 420 ft)
= 936 ft²

Volume = V_1 = $\frac{(936\ ft^2)(650\ ft)}{43{,}560\ ft^2/acre}$

= 14.0 acre-ft

$V_1 < \frac{S}{2}$ ∴ reach length OK

b. Determine $Q_{P4(TRIAL)}$

$$Q_{P4(TRIAL)} = Q_{P3}\left(1 - \frac{V_1}{S}\right)$$

$$Q_{P4(TRIAL)} = (2{,}120\ cfs)\left(1 - \frac{14.0}{S}\right)$$

Q_{P4} = 2,040 cfs

c. Compute V_2 using $Q_{p-4(TRIAL)}$

From Figure 3 determine stage for $Q_{p-4(TRIAL)}$

Stage = 3.5 feet

X-area = (0.5)(3.5 ft)(100 ft + 410 ft)
= 893 ft²

$$V_2 = \frac{(893\ ft^2)(650\ ft)}{43{,}560\ ft^2/acre}$$

V_2 = 13.3 acre-ft

d. Average V_1 and V_2 and compute Q_4

(1) $$Vavg = \frac{V_1 + V_2}{2}$$

$$V_{avg} = \frac{14.0\ acre\text{-}ft + 13.3\ acre\text{-}ft}{2}$$

Vavg = 13.7 acre-ft

(2) $$Q_{p4} = Q_{p3}\left(1 - \frac{Vavg}{5}\right)$$

$$Q_{p4} = (2{,}120\ cfs)\left(1 - \frac{13.7}{350}\right)$$

Q_{p4} = 2,040 cfs

D. Summary of Impact of tailwater on Stage of downstream reaches

1. determine total stage by adding the tailwater discharge and the dam failure discharge, and finding the stage for this total in Figure 3, ie

$$Q_{P\,TOTAL} = Q_{P\,Failure} + Q_{P\,TAILWATER}$$

2. Reach 1

$$Q_{P1\,TOTAL} = 4,910\ cfs + 2,200\ cfs$$
$$= 7,110\ cfs$$

STAGE = 5.5 feet

3. Reach 2

$$Q_{P2\,TOTAL} = 4,600\ cfs + 2,120\ cfs$$
$$= 6,720\ cfs$$

STAGE = 5.2 feet

4 Reach 3

$$Q_{P3\,TOTAL} = 4,300\ cfs + 2,040\ cfs$$
$$= 6,340\ cfs$$

STAGE = 5.9 feet

V Additional Discharge Calculations

A. Flows over flashboards -

Will be a submerged weir flow situation, and flow determined by

$$\frac{Q_s}{Q} = \left[1 - \left(\frac{H_2}{H_1}\right)^n\right]^{0.385}$$

where Q_s = discharge of submerged weir, cfs
Q = discharge of unsubmerged weir, cfs
H_2 = height of water surface above weir crest, downstream of weir, ft
H_1 = height of water surface above weir, upstream of weir, ft
n = 3/2 for rectangular weir

1. Water surface at crest of dam
   a. Compute Q for free discharge with $Q = CLH^{3/2}$

$$Q = (3.5)(50.5')(3.8')^{3/2}$$

$$\approx 1310 \text{ cfs}$$

   b. Find H_2 from Figure 1 (since this represents flow over spillway structure with flashboards removed)

for $Q = 1310$ cfs elev ≈ 705.9

$$H_2 = 705.8 - 704.0$$
$$= 1.8 \text{ feet}$$

   c. Thus $Q_s = Q\left[1 - \left(\frac{H_2}{H_1}\right)^n\right]^{0.385}$

$$= (1310 \text{ cfs})\left[1 - \left(\frac{1.8}{3.8}\right)^{3/2}\right]^{0.385}$$

$$\boxed{Q_s = 1125 \text{ cfs}}$$

2. Water surface at test flood elevation

a. Q [illegible]

$$Q = (35 \quad 0.5')(7.6')^{3/2}$$

$$\approx 3700 \text{ cfs}$$

b. from Figure 1

for $Q = 3{,}700$ cfs elev. = 709.2 ft

$$H_2 = 709.2 - 704.0$$
$$= 5.2 \text{ feet}$$

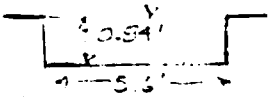
c. Then $Q_s = (3{,}700) \left[1 - \left(\frac{5.2}{7.6}\right)^{3/2}\right]^{0.385}$

$$\boxed{Q_s \approx 2680 \text{ cfs}}$$

3. Capacity of weir sections at normal pool

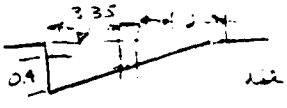
Take normal pool at 704.0 Compute discharge Through weir sections

a. rectangular weir section



$$Q = (3.3)(5.6')(0.84)^{3/2}$$
$$\approx 14 \text{ cfs}$$

b. Triangular weir section



using H ≈ 0.33+ and a typical weir coeff.

$$Q = (3.2)(7.35)(0.33)^{1.5}$$
$$\approx 5 \text{ cfs}$$

c. Total = 14 cfs + 5 cfs
= 19 cfs

END

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